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Popular Mechanics

The **FAST** *and the*
CURIOUS

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AND YOU**
WHY SA IS STILL
PLAYING CATCH-UP



04117

NEED vs DESIRE
11 GADGETS
YOU REALLY
WANT



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Go Further

FIRE-BREATHING MONSTERS. CREEPY ROBOTS. COOL GADGETS. A CENTURY OF DIY TIPS. WELCOME TO PM's WORLD

Our cover story this month, "The fast and the curious", is classic PM material, celebrating the left-field approach to design and construction evident in the annual Kinetic Grand Championship, a three-day event on the northern Californian coast described by writer James Vlahos as "equal parts inventors' showcase, artistic performance and serious race". We meet *Attack of the Funguys*, *The Heroes of Glorypolis*, *Visualize Whirled Peas* (don't ask) and the magnificently weird *Bottom Feeders* – a fire-breathing metal sea monster assembled from all manner of recycled junk, including cupcake tins. It's perfect.

We thought it entirely appropriate to acknowledge the 110th birthday of our parent magazine in the United States with a blockbuster-length article featuring the 110 best tips published in *POPULAR MECHANICS* since 1902. Some of them are inspiring, others are a little quirky, and a few are downright strange (example: convert an old car boot lid into an awning for the back door of your home).

What's interesting is that most of the tips have stood the test of time. In 1961, readers were informed that a transistor radio produced a "deeper, more melodious tone" when placed speaker-down on top of an open fruit jar; the same method enhances the sound from today's iPhone. The August 1955 issue advised farsighted PM readers to punch a pinhole in a piece of cardboard and peer through it to read small type. Try it for yourself: it works.

Our "In Focus" feature for April follows hot on the heels of Switzerland's annual Baselworld fair, showcase of the watch-making world's latest and

greatest designs – some of which elevate timekeeping to a very different level. New vintage is hot, skeletonised watches are cool, and "retro-mechanical" is the buzzword on everyone lips. (Hey, if it looks good on your wrist and tells you when it's okay to pour something fermented and chilled, we're happy.)

There's more, of course. We introduce a whole bunch of desirable gadgets (for the record, you *really* need a tactical torch), reveal the story behind a spring that revolutionised Nascar racing, build a Shaker shelf that would grace any sitting room, and tell you about Geminoid-F, a disturbingly lifelike robot that sat in a shop window and smiled at passers-by. We also take a look at South Africa's broadband connectivity and reveal why it's taking us a little longer than expected to get up to speed.

That should be enough to keep you going until next month. Stay with us.

Alan Duggan

aland@ramsaymedia.co.za



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Ian Dinan, RamsayMedia's circulation manager, accepted our prestigious Electric Sheep Award in recognition of his team's help in achieving PM's highest-ever circulation figure in January this year (we notched up sales of over 52 000). The sheep's transgender appearance has no significance.

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WIN



SUBSCRIBE TO PM
and you could drive
off in a 5-door
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1.6 worth over
R230 000
(see page 17)



WIN
→ One of 3
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David Coulthard
limited edition
timepieces worth
R9 950 each
(see page 77)



READER EVENT

Join **POPULAR MECHANICS** on
an escorted weekend trip
to the SALT telescope in
Sutherland and explore the
heavens in knowledgeable
company (see page 59).

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Cover: Yes, but is it art? Meet Bottom Feeders, a metal “sea monster” created for the annual Kinetic Grand Championship Race by 30-time participant Duane Flatmo. He built his fire-breathing machine from a dazzling array of recycled materials, including colanders and irrigation equipment. Photograph by Mark Peterson. This page: Dispensing how-to advice for 11 decades (and a more modest 9+ years in South Africa) has given **POPULAR MECHANICS USA** a good grip on the whole DIY thing. We present 110 of PM’s best tips ever – and a few odd ones, too.

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FOR OUR CURRENT SUBSCRIPTION RATES, SEE PAGE 17

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HOW ALIVE ARE YOU?





Winning
letter

GIVING IT GAS

I'm an Italian globetrotter and have been a passionate reader of PM ever since I started a business in my second country, South Africa, some years ago. I have to complain about your article, "Running on gas" (February issue); it doesn't represent the true picture. Natural gas and LPG are mixed up in the article but in fact they are totally different.

American manufacturers such as NatCarGas (a company born in 2008) are ridiculously small guys when compared with Italian manufacturers such as Landi Renzo, which has a 60-year history and enjoys a well-established partnership in South Africa through local distributors such as ADCENG. They could have provided you with more up-to-date and interesting information to share with your readers.

Fortunately, the use of gas in South Africa is more widespread than suggested in the article. There are so many options for gas power that could be exploited in this country if only the will existed among consumers: for example, the new Alfa Romeo Giulietta, the first car in its category to be made available with a Turbo LPG engine. Mercedes-Benz, Volvo, Fiat, VW, Opel and other brands are also available with natural gas or LPG power. It's just a matter of time before we see them over here, helping to reduce our carbon footprint and saving anything from 30 per cent (LPG) to 60 per cent (natural gas) in fuel costs per kilometre.

PAOLO ROMANI
VIA E-MAIL

Write to us, engage us in debate, and you could win a cool prize; this month's best letter wins a desirable CAT watch worth R1 995. CAT Timekeeping Equipment reinvents and contextualises the heritage and authenticity of the brand's core know-how – clean and urban, encased in finely engineered stainless steel, and equipped with a technically advanced movement. For more information, contact S Bacher & Co on 011-372 6000 or visit www.sbacher.co.za

Send your letter to: Popular Mechanics, PO Box 180, Howard Place 7450 or e-mail popularmechanics@ramsaymedia.co.za Please keep it short and to the point. Regrettably, prizes can be awarded only to South African residents.

Perpetual-motion machine? Perish the thought

As a regular reader of POPULAR MECHANICS, I am pleased that you normally avoid impossible engineering; however, it seems that one has slipped through the net. Did none of your journalists stop to question how the Mig 675 ("Upgrade", February issue) generates hydrogen from sea water?

While it is not advisable for journalists to rely on the ubiquitous Wikipedia for information, a cursory check could have saved you the embarrassment of effectively promoting a perpetual-motion machine. Bloggers and tech sites across the Internet have raised questions about the lack of detail on this "miracle" engine.

MICHAEL KNOTT
VIA E-MAIL

Editor's note: Whereas some of the concepts featured in our Upgrade pages are a little "out there", we have a horror of anything resembling perpetual-motion machines, "free energy" sources and the like. We assumed the manufacturers in this case were talking about some form of hydrogen fuel cell that delivered a limited amount of juice for the boat, and not a system that used the ocean as a kind of bottomless fuel tank. Such assumptions are risky, and in this case, it might have been wise to insert the word "reportedly". We'll be monitoring their progress.



Welding advice needed

I am looking for a retired welder who could give my husband some useful tips and practical information with regard to welding different densities of metal such as tubing, angle iron, etc.

He is capable of tackling most welds, but because it has not been part of his everyday job, he is getting frustrated with some of his work. We live in the Gauteng area, and I would be so grateful if this letter could be printed and some helpful person would

MANIE NEL
VIA E-MAIL



Be still, my stomach

Mac vs PC? (December 2011). Ad nauseam, and worse. Six years ago, I bought a Celeron-powered laptop running Windows. It got slower, blue-screened at least twice a year (necessitating a reload each time), and I bought a more expensive antivirus package; the machine just got slower and slower. Financial restraints prevented me from buying a newer model, and the laptop eventually ended up on the shelf – still operational, but excruciatingly slow.

Then I stumbled upon Ubuntu, and thought I would give it a whirl. At first, I did not like the OS very much, but Linux

grows on you. Retrieved from the shelf, Old Faithful now fires up quickly from switch-on, and I'm on the Internet in less than two minutes. I run Clam antivirus – a free download from the Ubuntu Software Centre with no noticeable degradation in PC speed, and I obviously run OpenOffice, which is very compatible with MS Office, and free as well. Your February issue article, "Removing yourself from the Internet", prompted me to add Cocoon to Firefox.

In a nutshell, Linux is free, works without fail (it's been going for over two years on my laptop) and restores life to older machines; let's not bother to bring Mac into the equation. I watch movies, edit and manipulate photos and music (free). Get Ubuntu, get a life.

PS: Excellent magazine.

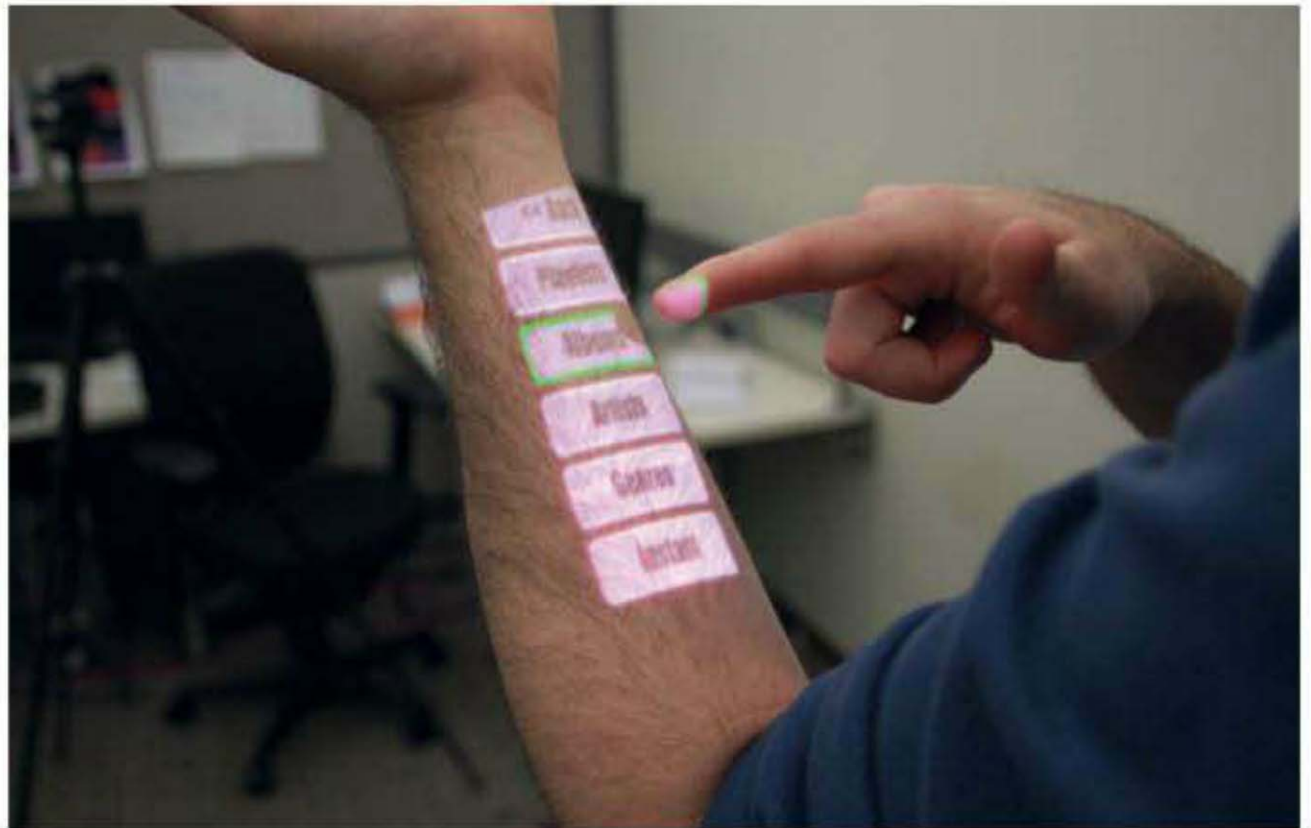
MANIE NEL
VIA E-MAIL

Addicted to ideas

I know it is virtually impossible to come up with an idea that is not already on the production line and about to be launched as I type, but there's something addictive about giving it a go. One such prediction has been buzzing about my head the last few days, and if the technology existed whereby thoughts could be Bluetoothed to my netbook, this e-mail would have been sent off ages ago. Guess that's just around the corner...

So here goes: instead of screens on mobile gadgets getting ever larger, why not incorporate technology that turns any surface into an interactive keyboard or screen? How about a miniature projector that could turn any wall into a screen for watching movies on the go, or for making video phone calls? If privacy is an issue, then perhaps spectacles with a built-in screen that connects wirelessly to the phone?

I've just done an Internet search using the key phrase "phone with projector and whiteboard technology", and nothing came up. While we're about it, could



we please have cellphones that are scratch-, drop- and waterproof to 10 m as standard?

DIANE HOLMES
HOGSBACK

Editor's note: You might like to explore something called OmniTouch. Developed

by a bunch of clever people from Microsoft Research and Carnegie Mellon University in the US, it's a wearable projection system that uses a modified Kinect to superimpose an interactive interface on to virtually any surface, including your arm.

respond. Contact on 083 399 2923.PS: Great magazine; even I read it religiously.
CHARLENE HARMSSEN
GAUTENG

Energy-efficient light – but at a cost

Your "Breakthrough Awards" (December 2011 issue) refers. The attached correspondence is self-explanatory and relates to my endeavour to source the Philips AmbientLED light bulbs mentioned in the article. The critical factor here is the price of R551 (excluding VAT) per bulb, as quoted by Keens via Philips. No one in their right mind would replace their light bulbs at such a restrictive cost.

JOHN FOURIE
VIA E-MAIL

Picture puzzle

I was interested in your article on the tragic Reno Air Race crash (Tech Watch, February issue) because I researched the event a few months ago for a school project. Here's my point: if you search the AP Images Web site, you'll see a whole bunch of interesting pictures available for purchase, but one of the most dramatic – showing the doomed P-51D in a steep dive, just a split-second before it hits the ground – is available only as a poor-quality

image that looks as if it was scanned from a newspaper.

What's interesting is that this is the only version of the image available anywhere on the Web. Is it a fake, a composite image?
TERRY CROWTHER
CAPE TOWN

Techno-gluttony

Devour. Almost every month, this word finds its way into your Letters pages; it describes how readers (me included) consume the latest issue of your magazine. Still on the subject of literary consumption, I would like to propose that PM assemble an "additional reading" list. Here are a few suggestions to get the ball rolling:

A Short History of Nearly Everything, by Bill Bryson (this will give you a fundamental grasp of almost any subject in any field of science).

Elephants on Acid and Other Bizarre Experiments, by Alex Boese (this will make you laugh in disbelief at the weird experiments dreamed up by crazy scientists).

Electrified Sheep, by Alex Boese (a sequel that focuses more on the lives of these crazy scientists).

At Home, by Bill Bryson (a fascinating read about domestic life and how it evolved through the ages).

The Hitchhiker's Guide to the Galaxy, by Douglas Adams (sci-fi comedy at its finest).

These ought to sustain you until the next issue of PM – and remember, "Don't panic!".

ALBERT WILLEMSE
CAPE TOWN

Editor's note: Nothing wrong with your taste in books. We could add a good hundred or so...

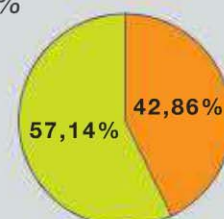
PM

MONTHLY POLL

Could natural nuclear reactors – such as the fossil reactor found at Oklo, Gabon, in 1972 – have kick-started life on Earth billions of years ago?

Possibly. An interesting concept, and perhaps more credible than the panspermia (dormant extremophiles drifting through space) or "alien seeding" theories. 42,86%

No way. The Archaean epoch was already hellish; adding huge dollops of radiation to the mix surely makes conditions even more unpalatable for life. 57,14%

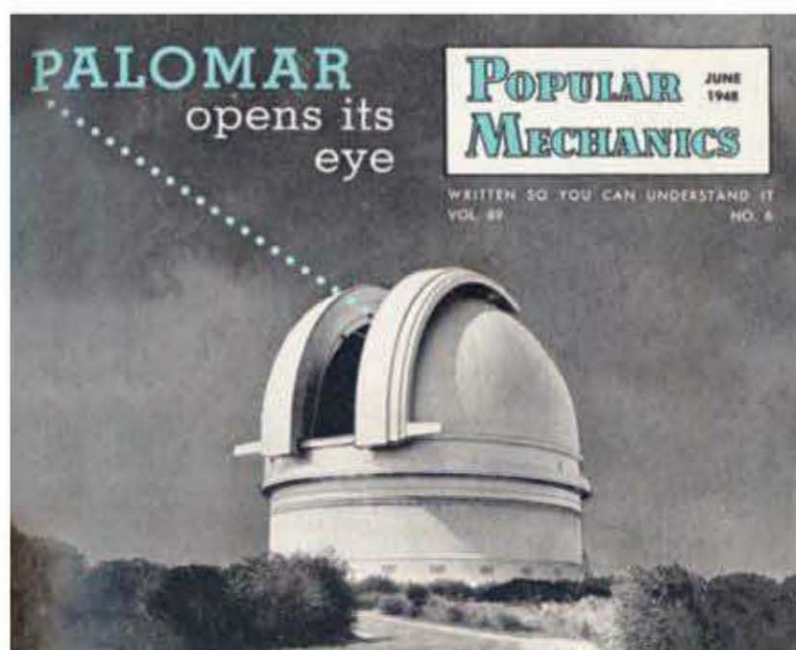


Conducted online at www.popularmechanics.co.za – visit PM's Web site to vote in our current poll.

1938



Ever eager to showcase useful medical breakthroughs, we published this picture of a dentist's patient who reportedly "gained confidence" when allowed to administer gas to herself using a simple hand-bulb control.



1948 One of the most important events in the history of astronomy was the completion of the 200-inch (about 5 m) Mount Palomar telescope in California, the largest and most sophisticated ever built. This amazing instrument, we announced, would enable us to peer a billion light-years into space – twice as far as any astronomer had been before.



1953 How's this for a radical idea? An American designer applied for patents covering several features of a concept whereby high-powered helicopter "tugs" would fasten themselves to incoming fixed-wing aircraft and gently lower them on to landing sites in downtown locations. Then, when the aircraft were ready to leave, the helicopters would lift them to a reasonable height, switch to horizontal flight, and detach themselves when they reached flying speed. This radical idea, which inexplicably failed to achieve fruition, called for powerful ramjets to be attached to the tips of the rotors.

PM

1961 Oh, the memories. Previewing Detroit's '62 line-up, we showcased the extensively restyled two-door Chevrolet Impala (yes, the name was derived from our antelope). The best-selling Impala was Chevrolet's most expensive passenger model for several years, and quite a few examples made their way to this country. It was available with a choice of engines, including a 6.4-litre V8 pushing out 299 kW. Sigh.



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TECH WATCH

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13,1 m

1,8 m

The business end of Harriet, the tunnel-boring machine, has fearsome incisors and crushers that can chew up 1,5 linear metres of rock per hour.



> Visit www.popularmechanics.co.za to find out how a huge tunnel-boring machine performs its earthmoving miracles.

Miami slice

At 13 m in diameter and 139 m long, the tunnel-boring machine (TBM) creating the Port of Miami Tunnel is among the largest of its type. Unfortunately, Harriet, as the R355 million giant is known, also happens to be slow. In the 35 days after she broke ground on 11 November 2011, Harriet progressed just 39 m. By June, she's scheduled to carve out 1 280 linear metres beneath Biscayne Bay.

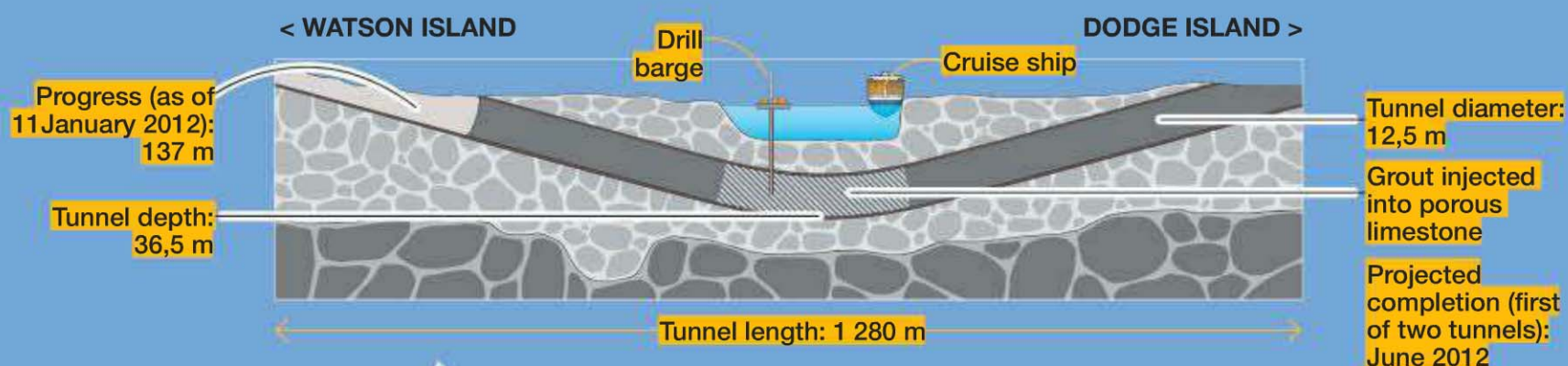
Project vice-president Chris Hodgkins attributes the snail's pace in part to the porous limestone that the 2 540-ton TBM

must plough through while cutting two parallel tunnels between Watson and Dodge islands. (The second tunnel is due for completion next year.) The tunnels will be a boon to the tourism and shipping industries; they will also ease traffic in downtown Miami by diverting cargo trucks and cruise-passenger buses.

"We have a Swiss-cheese situation we're trying to address," Hodgkins tells *POPULAR MECHANICS*. To fill in the nooks and crannies, a drill-and-fill operation pumps in grout to shore up the cutting path.

This is particularly painstaking beneath Government Cut, a shipping channel between Miami and the Atlantic. There, drilling barges must stop work to make way for cargo ships and cruise liners. "We can't get in the way of the mother's milk of the economy," says Hodgkins, who claims the project is on schedule despite the obstacles. But in addition to Harriet's awesome power and Hodgkins's troubleshooting, the project's success relies on one other ingredient: patience.

– AMANDA DEMATTO



■ TW UPDATE

ON THE WEB > Visit www.popularmechanics.co.za to discover how researchers are finding ways to harvest energy from insects, and taking the utility of these miniature cyborgs to the next level (search keyword: cyborg).

Self-powered cyborg bugs

Insects guided by remote control have been around for a few years (see Tech Watch, July 2009). But they continue to have the same problem as many tech gadgets: short battery life. University of Michigan engineers propose to fix this by gleaning energy from the insects themselves. The researchers attached piezoelectric harvesters to generate power from the wing movements of green June beetles. Other power-generation methods could include thermoelectric devices to tap body heat and solar cells. The electricity would run cameras, mics and gas detectors, making cyborg insects ideal first responders in cramped, hazardous situations. – ALEX HUTCHINSON

1. THIN-FILM SOLAR CELLS
2. SENSOR
3. PIEZOELECTRIC BEAMS

ACTUAL SIZE

■ QUICK HITS



Space, or something like it A massive new cryogenic vacuum chamber at the German Aerospace Centre in Göttingen will offer the interplanetary version of a wind tunnel for satellite and spacecraft testing. Researchers evacuate the 11,9 m-long, 4,9 m-wide "space tunnel" with a special cryogenic helium pump that creates a space-like vacuum and temperatures as low as minus 268 degrees. One of the key goals of the facility is to test ion-propulsion systems, which use electricity rather than combustion to accelerate satellites and spacecraft.



US Air Force gets its biggest bomb The Air Force Global Strike Command received its first GBU-57A/B Massive Ordnance Penetrator in September 2011. Guided by Global Positioning System, it is America's largest non-nuclear bomb, packing 2 400 kg of explosives and measuring 6,2 m long, according to the Pentagon. The bomb can penetrate up to 60 m of reinforced concrete before exploding – useful in destroying underground bunkers such as those in Iran and North Korea. The weapon will be carried by B-2 stealth and B-52 long-range bombers.

▪ WEAPONRY

The plastic pistol



Designed for the Austrian army by engineer Gaston Glock, the Glock 17 became the go-to handgun for European armed forces after its debut in 1982. Durable and inexpensive to produce, the Glock caught on fast in the US a few years later. "If you look at handguns in America, the Glock has had the kind of revolutionary effect on the marketplace that the AK-47 has had on high-capacity rifles worldwide," says Paul Barrett, author of *Glock: The Rise of America's Gun* (Crown, 2012). Today, it's the weapon of choice of police departments and millions of civilian shooters, and has become a pop-culture phenomenon: the Glock name has been dropped in movies and rap songs, and in David Foster Wallace's *Infinite Jest*. "The gun has taken on an aura beyond its use as an actual weapon," Barrett says. – ERIN MCCARTHY

■ Plastic body

The Glock's industrial-grade polymer frame keeps the weapon's loaded weight to 900 g, absorbs recoil, and guards against damage by salt water and sweat.

■ Trigger safety

Officers who used handguns with a traditional safety often forgot whether it was on or off. The Glock's safety protrudes from the trigger; to fire the gun, the shooter depresses both parts in one motion. "It was marketed as an innovation," Barrett says. "It's also the reason the design has been criticised by gun-control advocates, because there's no way to put it on full safety."

■ Trigger pull

A typical revolver has a 5,4 kg trigger pull. The Glock's pull is just 2,5 kg, making it easier to control. "A mediocre shooter can suddenly become more accurate," Barrett says.

■ Magazine

Shootouts in the 1980s persuaded cops that the six-round revolvers they had carried for 75 years weren't adequate. The Glock's 17-round magazine – and other innovative components – made it an ideal weapon. "The American gun establishment was caught unawares by Glock," Barrett says. "Before they knew it, it made a huge incursion into their market."

▪ MILESTONE

Happy trails, Voyager 1

Nasa's Voyager 1 space probe is poised to become the first man-made object to leave the solar system.

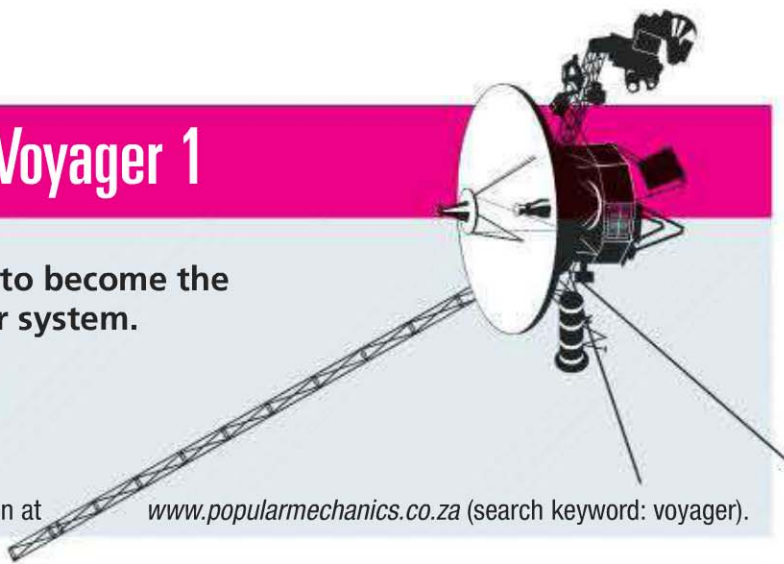
Launched: 1977 Speed: 64 000 km/h

Distance: About 17,7 billion km from the Sun

Exit: Expected between 2012 and 2015

ON THE WEB > Find out more about the Voyager mission at

www.popularmechanics.co.za (search keyword: voyager).



▪ QUICK HITS



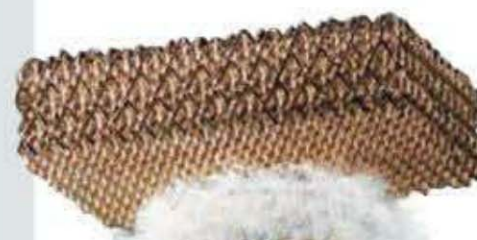
Repurposed commodity As electric cars gain popularity, the world is going to need a lot more lithium for batteries – and the US already imports about half of what it requires. California-based Simbol Materials has a solution: take the hot brine that's pumped out of the ground by geothermal power plants, and extract and purify the lithium. The process also plucks manganese and zinc – two other useful minerals for battery production – from the brine, then returns the liquid to the geothermal plant to be piped underground. Simbol started commercial production last year at a plant near the Salton Sea in Imperial Valley, California, which is expected to produce 500 tons per year of ultra-pure lithium. Later this year, the company will break ground on another facility that will increase production to 14 500 tons a year.

▪ MATERIAL MIRACLES

Empty metal

A group of scientists in California has created the world's lightest metal – 100 times lighter than Styro-foam. Working under a US Defence Department programme, the researchers crafted a micro-lattice of hollow nickel tubes that is 99,9 per cent air. Unlike other ultra-lightweight materials, this metal has an ordered structure that provides strength. Stress tests confirmed that the material can be compressed until it is half as thick and then rebound to its original shape. The researchers (in a collaboration of the University of California at Irvine, HRL Laboratories and the California Institute of Technology) say the material could be used for battery electrodes or to absorb vibration or shock energy in microelectronics.

– ALEX HUTCHINSON PM





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David Robert, 37, first officer; 6 500 flight hours. AT ABOUT 2 AM, ROBERT ENTERS THE COCKPIT AFTER A BREAK BUT LEAVES BONIN IN CONTROL.

Pierre-Cédric Bonin, 32, first officer; 2 900 flight hours. THE LEAST SEASONED PILOT HELMS THE PLANE DURING MOST OF ITS FINAL MINUTES.

Captain's side stick

First officer's side stick

Marc Dubois, 58, captain; 11 000 flight hours. WITH THE CRISIS UNDER WAY, HE RETURNS TO THE COCKPIT AFTER A BREAK BUT ELECTS NOT TO TAKE CONTROL OF THE AIRCRAFT.

■ WHAT WENT WRONG

Above: The cockpit of an Airbus A330-200.

The final minutes

AIR FRANCE 447'S COCKPIT RECORDINGS PROVIDE DEFINITIVE DETAILS OF THE CRASH. > BY JEFF WISE

The crash of Air France Flight 447 has remained a mystery since it occurred over the mid-Atlantic in the early hours of 1 June 2009. As PM found at the time ("Anatomy of a Plane Crash", December 2009), the available data implied that the Airbus A330-200's airspeed sensors had iced up, leading to a chain of errors that cost 228 lives. Now a fuller picture has emerged with the publication in France of *Erreurs de pilotage: Tome 5* (Altipresse, 2011) by pilot and aviation writer Jean-Pierre Otelli. The book includes the transcript of the pilots' final words – which leave little doubt that human error caused the tragedy. The transcript here (in yellow, edited for space) is followed by our analysis. The times listed in black are in co-ordinated universal time.

02:06:50 (Bonin) Let's go for the anti-icing system. It's better than nothing.

Flying through clouds at 35 000 feet, the pilots discuss turning on a system to try to keep ice off the sensors and flight-control surfaces. They do not. Ice reduces aerodynamic efficiency, adds weight and, in rare cases, can cause a crash. After fixing an incorrect radar setting, Robert notices that the plane is headed into an area of unexpectedly intense storms.

02:08:03 (Robert) You can possibly pull it a little to the left.

02:08:06 (Bonin) Sorry, what?

02:08:07 (Robert) You can possibly pull it a little to the left. We're agreed that we're in manual, yeah?

Bonin banks the plane left and then asks Robert if he should turn on a feature to prevent icing in the engines. He does. Then an alarm sounds. The autopilot is switching off because the plane's external airspeed sensors, called pitot tubes, have iced over. Neither Bonin nor Robert has been trained to fly the plane in such conditions.



02:10:06 (Bonin) I have the controls.

In an attempt to avoid the storms ahead, Bonin pulls back on the side stick to put the airplane into a steep climb. A warning chime indicates that Air France 447 is leaving its planned altitude. "If he's going straight and level and he's got no airspeed (data), I don't know why he'd pull back," says Chris Nutter, an airline pilot and flight instructor. The logical thing for the co-pilots to do would be to compare airspeed data, a procedure called a cross-check. Instead, Bonin puts the aircraft at risk of an aerodynamic stall. If an aircraft flies too slowly or too steeply, the wings stop generating lift and the plane starts to lose altitude. Climbing is risky because an plane's wings generate less lift where the air is thinner.

02:10:15 (Bonin) There's no good... there's no good speed indication.

02:10:15 (Robert) We've lost the... the... the speeds then?

The plane is climbing at a blistering 6 700 feet per minute, but its forward airspeed slows to a mere 93 knots. As the aircraft climbs, a stall alert – a synthesised voice calling "stall, stall" – sounds. AF 447's co-pilots fail to do what all pilots are trained to do when at risk of a stall – push the controls forward so the plane will level out and gain speed. In fact, Bonin inexplicably keeps pulling back on the stick.

02:10:25 (Robert) Wing anti-ice.

The co-pilots activate the other anti-icing system; almost immediately, one of the pitot tubes begins to work. The cockpit displays once again show valid speed information.

02:10:36 (Robert) Descend!

02:10:36 (Bonin) Here we go, we're descending.

02:10:38 (Robert) Gently!

Bonin keeps pulling back on the stick, but with less force. The plane reaches 223 knots as its climb becomes less steep. The stall warning falls silent. For a moment, the crew is in control of the airplane. Robert pushes a button to summon the captain.

02:10:49 (Robert) Damn it, where is he?

The plane is now within its acceptable altitude envelope. But Bonin again pulls back hard on the stick, raising the nose of the plane and bleeding speed. The synthesised voice again alerts them to a stall.

02:10:54 (Robert) Damn it!

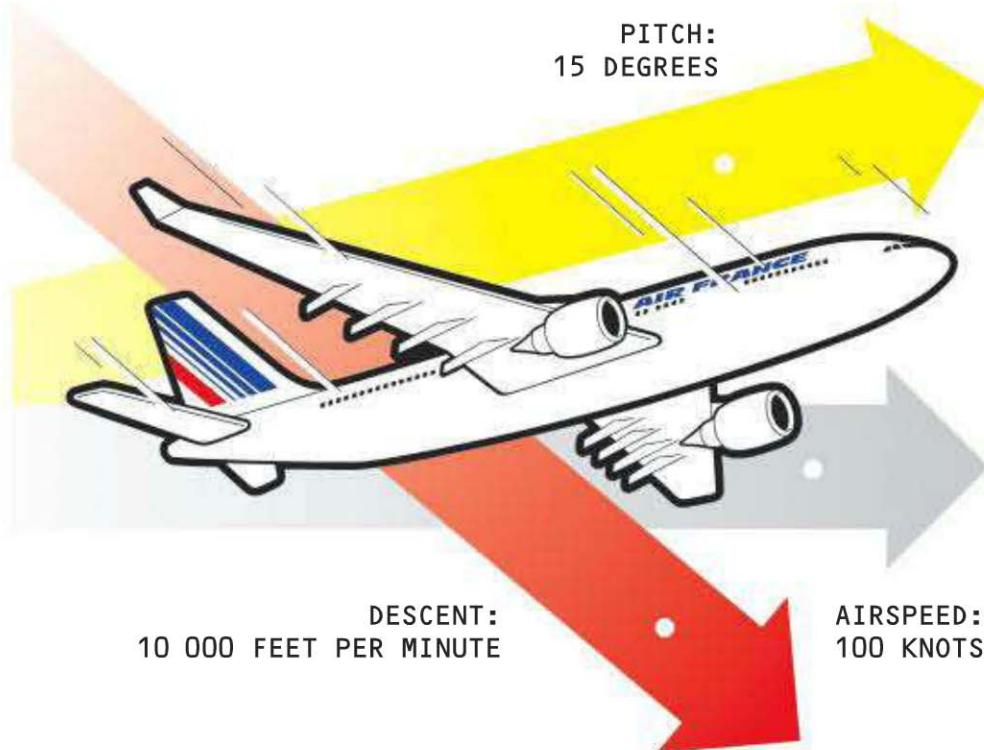
Another pitot tube begins to function. The cockpit's avionics are now all working normally; the flight crew has all the information that they need to fly safely. The stall that occurs from this point forward is due to human error.

The Airbus is a fly-by-wire plane, meaning the control inputs from the cockpit are fed to a flight-control computer, which in turn commands actuators that move the ailerons, the rudder and the elevator. The vast majority of the time, the computer operates within what's known as normal law, which means that the computer will not enact any control movements that would cause the plane to leave its flight envelope. The flight-control computer under normal law will not allow an aircraft to stall, aviation experts say.

But once AF 447's computer had lost its airspeed data, it disconnected the autopilot and switched from normal law to "alternate law", a regime with far fewer restrictions on what a pilot can do. Bonin may have assumed that the stall warning was spurious because he didn't realise that the plane had removed its own restrictions against stalling.

02:11:03 (Bonin) I'm in TOGA, huh?

TOGA is an acronym for Take Off, Go Around. When a plane is taking off or aborting a landing – "going around" – it must gain both speed and altitude as efficiently as possible. At this critical phase of flight, pilots are trained to increase



LETHAL EQUATION: AF 447 is travelling at 100 knots; the co-pilots have its nose pitched up 15 degrees. This posture does not generate enough lift, so the airliner descends 10 000 feet a minute, the air crossing the wings at a 41,5-degree angle. If the stick were released, the nose would fall, levelling out the plane and allowing it to gain forward velocity and escape the stall. But since the co-pilot holds back the side stick, the nose remains high and the plane lacks the necessary forward speed for the controls to work. The airliner maintains this position until it crashes.

engine speed to the TOGA level and raise the nose to a certain pitch angle. Bonin seems to be trying to achieve the same effect. He wants to increase speed and climb away from danger. But the aircraft is now in thin air at 38 000 feet, where the engines generate less thrust and the wings less lift. In these conditions, raising the nose does not result in the same angle of climb. The plane is at its maximum altitude.

02:11:21 (Robert) We still have the engines! What the hell is happening? I don't understand what's happening.

Even with engines at full power, with the nose pitched up, the aircraft's forward motion halts. AF 447 begins to sink towards the ocean.

Robert has no idea that, despite their conversation about descending, Bonin has continued to pull back on the side stick. Unlike the control yokes of a Boeing jetliner, the side sticks on an Airbus are "asynchronous" – that is, they move independently. "If the person in the right seat is pulling back on the side stick, the person in the left seat doesn't feel it," says David Esser, a professor of aeronautical science at Embry-Riddle Aeronautical University. "One stick doesn't move just because the other one does."



Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile

JUNE 2009: CRASH

("Anatomy of a plane crash," January 2010 issue) Air France Flight 447 disappears. Investigators rely on floating debris and automated maintenance messages.

JULY 2009 TO APRIL 2011: UNDERWATER SCANS

French authorities use a military submarine and autonomous underwater robots to search the seafloor for wreckage. They find it in April.

MAY 2011: BLACK BOXES RETRIEVED

("Plumbing the depths of disaster"; Tech Watch, August 2011) Investigators deploy a diving robot to fetch AF 447's black boxes.

OCTOBER 2011: TRANSCRIPT OF THE COCKPIT RECORDER RELEASED

Author Jean-Pierre Otelli publishes the full transcript of the flight crew's final moments. The release sparks a debate over the way pilots are trained to react if a plane's autopilot fails.

02:11:32 (Bonin) *Damn it, I don't have control of the plane, I don't have control of the plane at all!*

If Bonin were to let go of the controls, the nose would fall and the plane would regain forward speed. But because he is holding the stick all the way back, the nose remains high and the aircraft has little forward speed. The stall continues.

02:11:43 (Dubois) *What the hell are you doing?*

A minute and a half after the crisis began, the captain returns to the cockpit. The stall warnings are blaring. But from his seat, Dubois is unable to infer from the instrument displays why the plane is behaving as it is – because Bonin has been holding the side stick all the way back. No one has told Dubois, and he hasn't thought to ask. He does not order the less experienced co-pilot to get up so he can take control.

"They were probably experiencing some pretty wild gyrations," Esser says. "In a condition like that, he might not necessarily want to make the situation worse by having one of the crew members actually disengage and stand up."

02:11:45 (Bonin) *We've lost control of the plane!*

Though the pitot tubes are now fully functional, the forward airspeed is so low that the angle-of-attack inputs are no longer accepted as valid and the stall-warning temporarily stops. This may give the pilots the impression that their situation is improving, when in fact it signals just the reverse.

02:12:14 (Robert) *What do you think? What do you think? What should we do?*

02:12:15 (Dubois) *Well, I don't know! We're going down.*

As the plane is tossed by turbulence, the captain urges Bonin to level the wings – advice that does nothing to address the main stall problem. The men briefly discuss whether they are in fact climbing or descending, before agreeing that they are indeed descending. No one mentions the word "stall".

02:13:39 (Robert) *Climb... climb... climb... climb...*

02:13:40 (Bonin) *But I've had the stick back the whole time!*

At last, Bonin reveals the crucial fact.

02:13:42 (Dubois) *No, no, no... Don't climb... no, no.*

02:13:43 (Robert) *Descend, then... Give me the controls... Give me the controls!*

Bonin yields the controls, and Robert puts the nose down. The plane descends at a precipitous angle. As it nears 2 000 feet, sensors detect the fast-approaching surface and trigger a new alarm. There is no time left to build up speed by pushing the plane's nose forward into a dive. At any rate, without warning his colleagues, Bonin regains the controls and again pulls his side stick all the way back.

02:14:23 (Robert) *Damn it, we're going to crash... This can't be happening!*

02:14:25 (Bonin) *But what's happening?*

02:14:26 (Dubois) *Ten degrees of pitch...*

The cockpit voice recordings stop 1,4 seconds later.

PM

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THE FAST & THE CURIOUS

WHAT'S OVER 3 METRES TALL, BREATHES FIRE AND ENGAGES DOZENS OF BICYCLE GEARS TO CROSS LAND, SAND AND SEA? A VEHICLE BUILT TO CONQUER CALIFORNIA'S KINETIC GRAND CHAMPIONSHIP.

BY JAMES VLAHOS > PHOTOGRAPHS BY MARK PETERSON > ILLUSTRATIONS BY SYLVIA PARK



VIDEO > Visit www.popularmechanics.co.za to watch PM's favourite vehicles from the Kinetic Grand Championship.



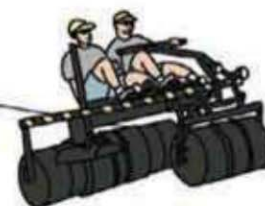
At the start of the three-day, 67 km Kinetic Grand Championship race, Bottom Feeders (opposite) breathes fire in the plaza of Arcata, California. Thirty-time participant Duane Flatmo created the metal beast using parts from previous years' vehicles. On day two, Visualize Whirled Peas (above) begins to traverse Humboldt Bay with the writer as a co-pilot.

A 4-METRE PICNIC BASKET blocks the road ahead of us, a towering bottle of cabernet jutting from the top and ants the size of kindergartners scaling the wicker sides. As the basket sits in traffic, a herd of human giraffes – spotted tights, papier-mâché heads – sweeps by. Then from behind comes the sound of clanking metal. I turn around to confront a silver sea monster on wheels. Front-mounted lobster claws chomp hungrily, dragon jaws on the roof open wide, and a long tongue of flame scorches the sky.

Such are the sights of the Kinetic Grand Championship, a three-day event on the northern California coast that is equal parts inventors' showcase, artistic performance, and serious race. It's the Daytona 500 meets Burning Man (a week-long "radical self-expression" event in the Nevada desert that climaxes in a bonfire topped by a

giant wooden effigy). Using no motors, the picnic basket, the sea monster and three dozen other human-powered absurdities will travel 67 kilometres through the far north of California between the cities of Arcata, Eureka and Ferndale. Though they look like carnival floats on acid, the contraptions must be designed to drive over tar, dirt and sand dunes, and even to navigate moving waters. "Kinetics is about art, speed and engineering," says Monica Topping, former president of the organisation that puts on the race. "It's the triathlon of the art world."

There are nearly a dozen kinetic races around the United States, all of them inspired by this event. It was launched in 1969 by local artists Hobart Brown and Jack Mays and first won by a turtle that belched smoke and laid eggs. The event begins at Arcata's main square, where



thousands of spectators snap pictures and a marching band plays hits from the 1980s. A slice of cake creeps past a pod of dolphins. A gangster's getaway car moves beside the space shuttle Endeavour. The Heroes of Gloryopolis rolls slowly along with a team of Marvel Comics-esque superheroes patrolling a metropolitan skyline. Ten pilots below pedal bikes welded to the remains of a Ford Ranger chassis. The machine was engineered by resident Carl Mueller, who, like many kinetic racers, has an almost compulsive desire to tinker with everything from Lego to vintage steam locomotives. "I was born with a wrench in one hand and a gear in the other," he says.

And then there's the kinetic sculpture that I'm helping to race. I hunker down in a putrid-green, three-wheeled dune buggy called Visualize Whirled Peas, or VWP for short. Decorated with dangling tennis balls and spinning pinwheels, it has one tyre up front and two in the back, and there's a similar configuration of seats for the trio of pilots. To my right is VWP's inventor, Mike Ransom, who built the contraption from donated dirt-track tyres, abandoned bikes and other dumpster-diving finds. Whether they are anti-car environmentalists or monster-truck fans, most racers, like Ransom, relish the challenge of turning trash into rolling treasure.

"How many bikes died to make that float?" a man on the street asks.

"Probably about six or seven," Ransom says. Each VWP pilot has pedals underfoot and controls a set of either 18 or 21 bicycle gears, which in turn feed into six more gearing ranges. Ransom, a computer programmer at the University of California, Davis, boasts that VWP has 244 944 possible gearing combinations. "Rube Goldberg would be proud!" the man replies.

A Kinetic Kop, wearing the buttoned coat and tall hat of a 19th-century British police officer, approaches VWP. He checks that we have the toothbrushes, the horn, the 10-litre bucket and other items mandated by the gleefully arcane rules of the contest. The inspection ends, and at noon, a siren cuts through the air. Pedalling furiously and jockeying for position, Team VWP makes three laps around the square, then heads west out of town. The race is on.



OKAY, BE DIFFICULT. Ask why. Why would people spend hundreds of hours to create all-terrain racing sculptures? The obvious answer is because kinetic racing is fun, but the rationale goes deeper than that. Events such as the Kinetic Grand Championship attract both studio artists and grease-stained engineers with the same intoxicating lure: an oddball challenge whose arbitrary constraints inspire wonderfully unconventional solutions. The mandate that all entries be human-powered makes the race more accessible to students and hobbyists. And the no-engines rule gives the race a third component besides artistic design and mechanical engineering – human sweat. "I've always loved the physical, athletic part of the race," says racer Duane Flatmo, a 30-time participant.



Racers push Attack of the Funguys – which won the Most Improved and Best Pit Crew awards – up dunes on Samoa beach (far left). The pilots of The Jeep and The Heroes of Gloryopolis share a laugh at the start of the race (left). Woody Endeavour takes on Dead Man's Drop (above). Of the ACE teams – that completed the entire race without using relief pilots or breaking other special rules – Woody Endeavour finished second place for time.

This year Flatmo rides in Bottom Feeders, the fire-breathing sea monster he created. An artist who is as comfortable with paint on canvas as he is with taking a blowtorch to steel, Flatmo has competed on the TV show *Junkyard Wars* and performed a musical number – playing a flamenco guitar with an electric eggbeater to strum the strings – on *America's Got Talent*. He built Bottom Feeders with a dazzling array of recycled materials, from cupcake tins and colanders to irrigation equipment and pieces of aircraft wings. "I try to create a piece of eye candy, something that people just can't help but get out their camera and take a picture of," Flatmo says.

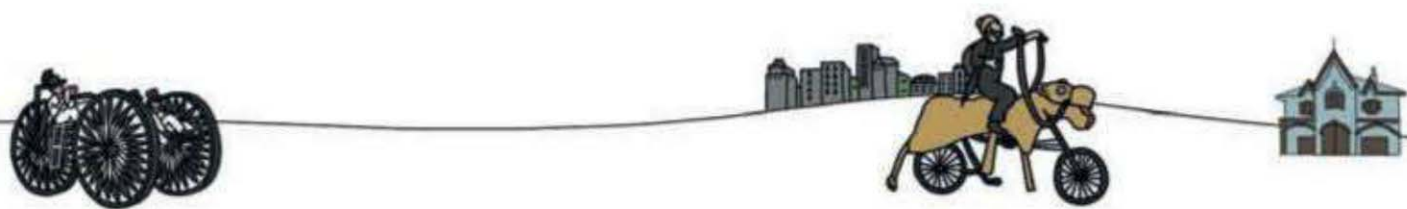
Bottom Feeders falls behind VWP as we pedal out of town into an agrarian landscape. Cows cluster against fences that line the two-lane road and stare at

the sculptures passing by. Cruising atop oversize tyres, VWP passes a rickety white taco truck. Papier-mâché skeletons, one dressed as a bride and the other as a groom, sit in the front seats and grin toothily. Newlydeads, reads the sign over their heads.

A couple of hours later, after driving down a long stretch of beach with waves sliding up beneath the tyres, we turn inland and face a steep set of dunes. VWP makes it up the first one, but stalls midway up the second. No matter how much we strain against the pedals, the machine won't move forward. The front wheel starts lifting up off the steep slope, and the whole contraption tilts dangerously backward. "Okay, that's it!" Ransom calls, signalling for everyone to jump off. "We're pushing." After we reboard at the top of the hill, which is called Dead Man's Drop, a judge asks if we want to scout the steep descent on foot. "Nope, we'll be fine," Ransom replies as we wheel over the sandy lip. And he's right.



THE NEXT DAY opens with a short sojourn through Humboldt Bay. The Jeep, a black, 1½-ton monster pick-up with four-wheel drive and four-wheel steering, loses a pontoon 50 metres in and begins to capsize, causing at least one co-pilot to jump overboard, screaming. The Jeep was overbuilt by design, says its maker, Chris Gardner. "I looked at all the other sculptures and they're awesome pieces of engineering, light and little, but they're not rock



CRAZY RACES

BOLD TINKERERS ARE TURNING ORDINARY OBJECTS INTO WHOLLY ORIGINAL HOMEBUILT VEHICLES. FROM BAR STOOLS TO POWER TOOLS, HERE ARE THE WEIRD AND WACKY WAYS DIYERS ARE SATISFYING THEIR NEED FOR SPEED.

BY KATIE HENDRICK

BAR-STOOL RACES

Many have barked brazen words from atop a bar stool. But only the truly intrepid add skis and take the souped-up seat for a ride down a snowy slope. The stools must be at least 70 cm tall, and contestants have to stay seated for the 320-metre sprint. The sitting rule began in 2000 primarily for rider protection, though staying seated also lowers the centre of gravity, which increases stability and speed.



Adventurous souls leave their beers on the bar and strap skis to stools in the annual race in Drummond, Wisconsin (above). The duct-taped boats in Key West's annual Minimal Regatta are as likely to sink as make it to the finish line (right).

COLLEGIATE CONCRETE CANOE RACES

To create the concrete boats for the championship "America's Cup of Civil Engineering", competitors use concrete made of expanded glass spheres, multiple cementitious materials and specialised admixtures. Teams spend upward of 4 600 hours researching, constructing and training. "You're out there on the lake with 20 other teams, and everyone's waiting to see which canoes turn into submarines and which will take it away, usually determined by tenths of

a second," says Kyle Marshall, who competed for four years.

POWER-TOOL DRAG RACES

"Until you've tasted the thrill of victory and smelled ionised electricity and burning rubber, electrical insulation, and, sometimes, flesh, you really haven't lived," says Jon Larson of this annual power-tool race. Racers turn



Another wheeled event allows DIY types across America to embrace their inner mechanic by building and racing retro-classy "cyclekarts". In South Africa, the closest we come to this genre is the Red Bull Boxcart Race, an irregular and thoroughly enjoyable showdown featuring machines that sometimes defy description. PM's first effort, an aluminium-bodied beast called Popularsaurus (above), finished in 5th place on its first outing.



electric concrete saws, angle grinders and other tools into makeshift motors that power skateboards, scooters, bikes and go-karts. All entrants must use recognisable mains-powered tools (up to 20 amps) that can be reused post-race.

CYCLEKARTING

This group began as a handful of self-professed "disenfranchised, alienated and enlightened eccentrics"

with a love for DIY projects and disdain for the status seeking of the automobile world. Often inspired by actual cars – including Bentleys, Millers and Bugattis – cyclekarts are nimble, elegant machines that can travel up to 60 km/h. And none are as expensive as they look. In fact, Michael Stevenson of the Association of MotoCycleKartistes says that the group has dismissed members who created more

ostentatious designs. "They just didn't get what it's all about."

MINIMAL REGATTA

In Key West, Florida, this homebuilt-boat race allows only a few materials – a sheet of plywood, half a kilogram of fasteners, a roll of duct tape, two 50 x 100 beams – to create vessels that resemble everything from surfboards to Spanish galleons. Steve King, a 20-year veteran, enters for the gratification of "building something no one expects to float and knowing that sinking's almost as fun as winning."

THE GREAT WEST END & RAILROAD SQUARE HANDCAR REGATTA

"For the delight and edification of all who attend," this race challenges participants to relive the era when the railroad was king, while applying today's style and gear. The only regulation: no motors, batteries or rubber bands. "Entries have to be human-powered," says event co-creator Ty Jones, "which means a lot are based on bicycles that are cut up and reloaded back in different configurations." Aside from the common presence of spokes, aesthetics vary widely. Jones has seen designs resembling traditional pump cars, mouse wheels, and even the ship from Willy Wonka & the Chocolate Factory.



Before they become Grand Champions, ACE medallists and Pageantry winners, the Tempus Fugitives – headed up by James Smith – enjoy a smooth section of road on their way to victory. It is Smith's third time racing in this machine.

crawlers," the 21-year-old says. "I wanted to build a tank."

I'm not comforted by his accident, nor by the conversation I had the day before with Dave Richards, a judge who was inspecting VWP. "You'd tell us if this thing was going to fall apart, right?" I asked.

"Oh, heck no," he said. "We hope for sinkers." But VWP crosses flawlessly. Styrofoam pontoons on each side of the craft keep us afloat. Paddle blades made from cut-up paint buckets and temporarily mounted on the wheels supply the propulsion.

Ransom is upset that VWP didn't do better on the climb up Dead Man's Drop,

but is excited at how well we handled the water crossing. The strength of his reactions is a revelation: the inventors behind this rolling circus take their contraptions seriously. It isn't that most participants are out to be the fastest on the course – one of the most coveted prizes is the Medio-CAR Award, given to the team that finishes exactly in the middle. Instead, artistic flair and engineering ingenuity are what's valued. The race is not about who can get to Ferndale first, but who can get there best.

Late in the race, VWP pulls abreast of Bottom Feeders on a long hill. I look over at Flatmo; he looks over at me. We point at each other in mock menace, then both start pedalling madly. Dune buggy and sea monster trade leads for 30 metres, but then the sound of a popping chain comes from Bottom Feeders. They pull over for a quick repair as we laugh and continue onwards.

We reach the top of Loleta Hill, which punishes racers with one and a half kilometres of 7 per cent grade, and dismount to catch our breath. In the end, Team VWP will finish in the middle – not fast enough to win a top prize, nor average enough for the Medio-CAR Award. But Ransom is happy simply because his machine has held together. "Blood, sweat and gears," he says to nobody in particular, and hops back aboard. **PM**

Best tips ever

By the Editors ● *Pictures by Dwight Eschliman; prop styling by Megan Caponetto*

ILLUSTRATIONS BY GARY MUSGRAVE

TYPOGRAPHY BY SPENCER CHARLES

Over the past 110 years, POPULAR MECHANICS in the US has published more than 1 300 issues filled with inspiring and sometimes quirky tips (rat-



In one of our very first issues, back in 1902, we told the story of a schoolboy named Mark Richards, who built a car for himself. By saving money from his after-school job blacking stoves, Richards cobbled together enough parts to assemble a runabout that rolled on four skinny tyres and was powered by a single-cylinder engine.

"I had no knowledge of the principles and practice of gasoline (petrol) engine construction," Richards said, "yet I not only managed to make it but to build the transmission mechanism, friction clutch, spark-timing mechanism, body running gear, etc, even doing the necessary blacksmithing... I stuck to the job and am gratified with the result."

If Mark Richards were alive today, he would love the story of Bob Dullam, a sculptor in Kalamazoo, Michigan, who received one of our 2009 Backyard Genius Awards for building a replica of the Tumbler Batmobile. Dullam fabricated a steel chassis and laid on body plates made of epoxy reinforced with glass fibre mat, then dropped in a 350 Chevy V8 and slapped on 44 inch-wide Super Swamper tyres. Why did Dullam spend R400 000 on his beast? "I like Batman," he explains, "and the only way to get this car was to build it myself."

The impulse to tinker, to putter, to do it yourself instead of buying it or paying someone to do it for you... Richards and Dullam share that mindset with millions of do-it-yourselfers. Sometimes, economic necessity drives this impulse, and other times the motivation has no price tag – it's the pride and freedom that come with self-reliance.

In 2012, as the US edition of POPULAR MECHANICS celebrates 110 years in publication, self-reliance remains a guiding principle of the magazine. Although PM's long-standing slogan, "Written So You Can Understand It", no longer appears on the cover, the magazine's mission remains the same: use plain language to present stories about how things work – whether those things are internal combustion engines, supercomputers or spacecraft – as well as how to make and fix things yourself. Indeed, POPULAR MECHANICS has depicted and fostered DIY for more than a century in the US (and going on 10 years in South Africa), which is why we chose it as the subject of this month's cover story.

To guide the masses, the early issues of POPULAR MECHANICS were aimed at the initiated. Many readers were part of the rising class of mechanical professionals, people who knew how to fashion a mitre joint, operate a lathe, and handle a drill press. The magazine's Shop Notes offered advice on "How to Temper Springs" and "Punching Structural Steel for Locomotive Tenders", while Amateur Mechanics taught younger readers how to make such things as a dovetail-joint puzzle.

After a lull during World War II, DIY exploded

along with the postwar economic boom, and while Detroit kept cranking out ever more exotic cars, gearheads were out in the garage using yesteryear's models to concoct their very own one-of-a-kind kandy-kolored tangerine-flake streamline babies. PM responded in 1962 by introducing one of our longest-running and most avidly read sections of the magazine, Saturday Mechanic.

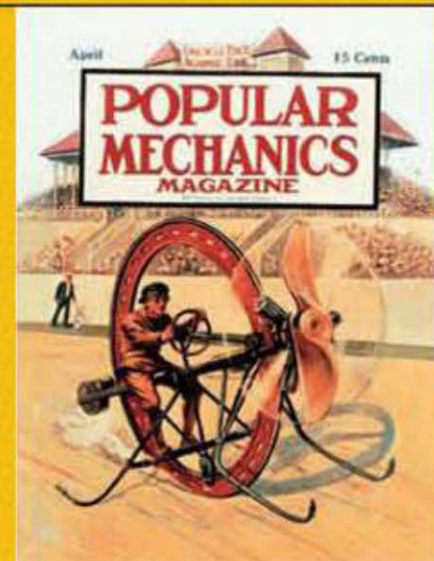
Beginning in 1971, Appliance Clinic helped readers deal with a deluge of electronic devices and household appliances; a decade later, computers were added to the mix with the advent of Software Monitor. A California kid named Steve Jobs, who grew up building Heathkit electronics projects, would later say that his boyhood forays into DIY "gave a tremendous level of self-confidence, that through exploration and learning one could understand seemingly very complex things". After dropping out of college, Jobs retreated to his parents' garage with a buddy named Steve Wozniak to modify the first personal computer, the Altair 8800. You know the rest of that story.

Jobs would later say that one of the "bibles" of his generation was The Whole Earth Catalog, a DIY project begun in 1968 by Stewart Brand, who put issues together with a couple of friends using an IBM Selectric typewriter and a Polaroid MP-3 camera. While the catalogue appealed primarily to the counterculture, and PM stuck to the mainstream, both publications celebrated self-reliance. "It was all about empowering individuals," Brand says. "The people who read it were interested in starting over from scratch."

Although the DIY mindset seemed to fade in the 1980s and '90s with the rise of the digital era, it returned in a new form at the start of the 21st century. While computer modding has roots in the late 1970s, its analogue cousin – the maker movement – sprang to life in the early 2000s. Happily for PM, we are now in the midst of a hands-on creative resurgence. "What's going on today is fantastic," Brand says. "... what you've got now is a tech-friendly generation of young people who are aware they can mess with the hardware as much as the software."

In fact, it's a safe bet that someone is out in the garage right now, working on the next big thing. Tinkering, puttering, hacking. Doing it himself.

– BY BILL MORRIS



1902–1925:

INDUSTRIAL ROOTS

PM founding editor HH Windsor writes for an audience of tradesmen and farmers already familiar with machining, wiring and wood-working. Doing it yourself is essential to making a living. Shop Notes and Amateur Mechanics sections show how to hone these skills in stories such as May 1908's tutorial on fixing a machine's broken flywheel, or a December 1917 project, "Electric bolt lock made from bell ringer".

1902

1925–1940:

THE WORKSHOP COMES HOME

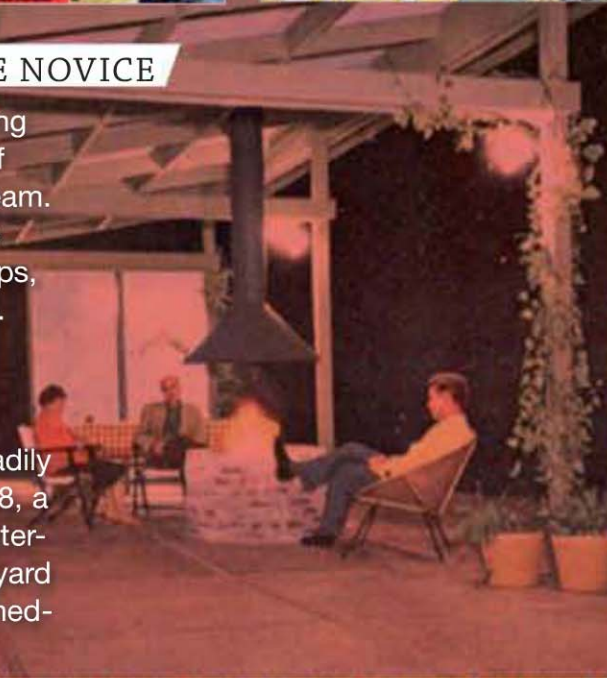
POPULAR MECHANICS covers promise bold breakthroughs, but the magazine's how-to pages grapple with the hard realities of the Great Depression. Tips emphasise reuse of items such as inner tubes and crank-cases. Workers apply trade skills to tasks at home, as projects explain how to vermin-proof an icebox drain, in May 1927, or how to hook a tray on to a beach umbrella, in September 1936.





1940-1965: RISE OF THE NOVICE

The postwar surge in new housing makes DIY a fundamental part of owning a home and living the dream. POPULAR MECHANICS' Solving Home Problems section tackles leaky taps, broken clocks and sticky drawers. Projects retain a sense of thrift – empty 35 mm film canisters become picnic saltshakers in May 1947. The homeowner steadily rises to prosperity. By July 1958, a typical story shows how to entertain guests with a new backyard smoker (made from a cleaned-out oil drum).



1985-2005: THE AGE OF SWEAT EQUITY



DIY remains satisfying as a creative enterprise, but it gains allure as a way to maximise an investment. An April 1987 feature titled "Doing It Yourself" demonstrates how a weekend upgrade can translate into money saved. Hardware stores grow larger, and the range of options they offer a homeowner expands. POPULAR MECHANICS begins running regular tool tests to explain how to choose a hammer – not just any hammer, but the best hammer money can buy.

1925

1940

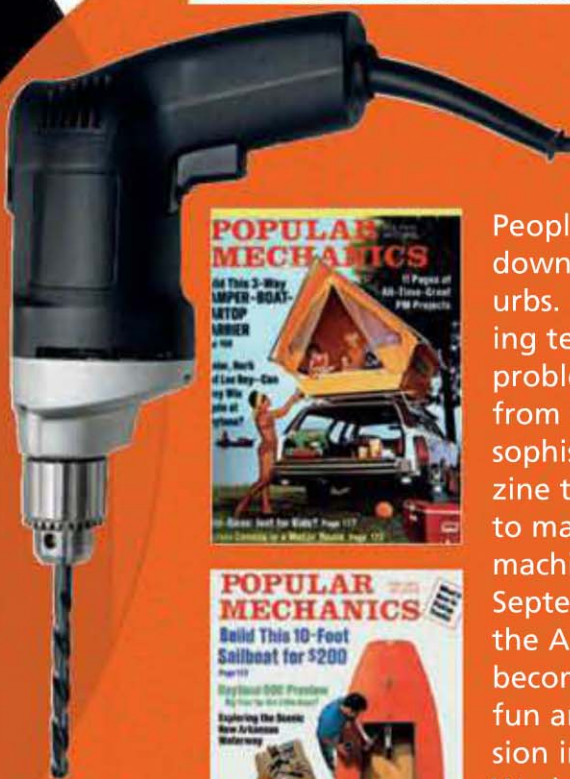
1965

1985

2005



1965-1985: THE WEEKEND-PROJECT ERA



People continue to put down roots in new suburbs. As tastes and housing technology evolve, problem-solving changes from homespun to sophisticated. The magazine turns its DIY advice to maintaining new machines with the September 1971 debut of the Appliance Clinic. DIY becomes an outlet for fun and creative expression in the Weekend Workshop section, where detailed home-build stories such as March 1972's "A Backyard Storage Building That Isn't an Eyesore" define the times.

2005-present: THE MAKER REVOLUTION



As some sectors of domestic manufacturing erode, the DIY zeitgeist shifts again. The act of making anything – plywood shelves, plumbing-pipe lamps, backyard rollercoasters – is respected and celebrated in stories such as POPULAR MECHANICS' annual Backyard Genius franchise and September 2009's "Ruggedise Your Own Tech". Technology and communication offer new ways to share creations with like-minded communities such as those featured in May 2011's "DIY Underground". But the abstract nature of the digital age also stokes an enduring need to create an object that can be held, used, taken apart, and put back together.

*** Brace for boards**

Our September 1948 issue showed how to store an ironing board upright in a cupboard by mounting a towel rack to a wall. The board's tip slips up under the chest-high rack. It's still a good idea. At the right height, a rack (or a rig made of steel pipe fittings) could support brooms or timber.

*** Find a key, fast**

File a notch in a frequently used key's top to locate it without having to look through the whole set. – April 1984

*** Copper wire torch stand**

To set up a simple work light, coil 12-gauge copper wire around a torch's barrel and twist the rest into a base. – March 2011

*** Got that spanner?**

On band saws, router tables or other workshop equipment that requires a spanner to make routine adjustments, we advised in July 1952: press the spanner into a lump of weather-stripping putty and stick the putty on the side of the tool. The spanner will be easy to locate for quick changes of bits and blades.

*** Pinhole lens**

The August 1955 issue told a far-sighted person to punch a pinhole in cardboard and peer through it to read small type. It still does the trick!

*** Jar pumps up radio tunes**

"Transistor radios produce a deeper, more melodious tone when placed speaker-down on top of an open fruit jar." This worked in February 1961. And it works today for an iPhone.

*** Fortify studs**

Nail 5 x 10 cm blocking between studs when framing drywalls, we suggested in November 1948. The boards provide sturdy mounting bases for heavy pictures or recessed medicine cabinets. Record the positions upon installation.



◀ FIT BOTTLE CAPS ON TO C-CLAMP PADS TO MAKE A MARK-FREE CLAMP. – JANUARY 1963



• MARCH •
Hole in One

Enlarged screw holes can be quickly repaired, we said in March 1972, by filling the hole with a wooden golf tee. Use a hacksaw to cut the tee flush with the wood's surface, then sand and finish.



- **ADD SAND TO FLOOR PAINT, ABOUT 100 G/LITRE, FOR A SKID-FREE COAT.** – FEBRUARY 2010
- **MIST WATER AT A SPARK PLUG AS A VEHICLE IDLES. VISIBLE ARCS SHOW VOLTAGE LEAKS.** – FEBRUARY 1995
- **FILL EMPTY SHOTGUN SHELLS WITH MELTED WAX AND A WICK TO MAKE CAMPSITE CANDLES.** – FEBRUARY 1961

* **Dry up paint drool**

Punch holes in a paint-can rim with a 4d finish nail. This helps paint along the rim drain into the can. – January 1991

* **Get a handle on a broken tool**

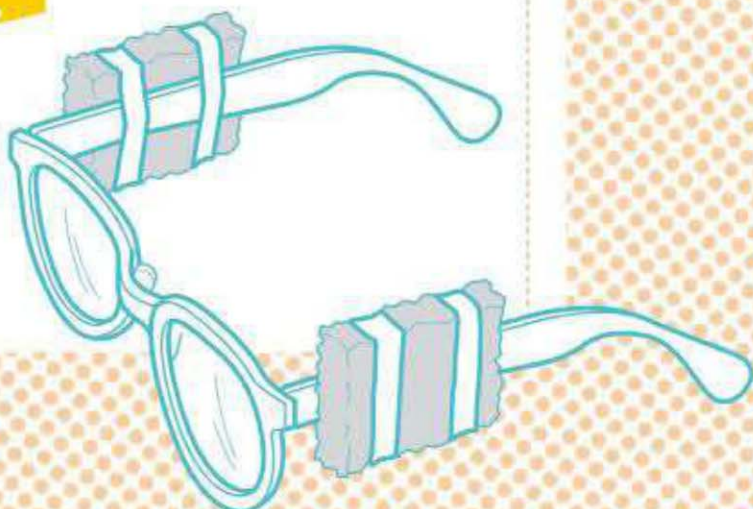
"Replacing a shovel handle is one of those disappearing rural skills that shows basic mechanical competence – just as wrapping duct tape around a broken handle denotes the opposite," the May 2007 issue said. Getting a wood handle's grain direction right ensures the strength of a replacement handle. Mount the new handle so that the oval rings of wood grain run up and down the sides of the handle relative to the blade. Handles break when the tool is strained along those ovals. A look down the blade toward the face of the handle should reveal only straight, parallel lines of wood grain.

* **Slow-leak test**

A tyre tip from December 1935: to locate a pinhole leak in a bike tyre's inner tube, hold it under water and watch for bubbles.

* **Floating frames**

Our August 1965 issue recommended taping small blocks of Styrofoam to eyeglasses' bows, or legs, while fishing or boating. If the glasses go overboard, they'll float.



• AUGUST •
1934

Depression-era milk thieves met their match with the bandit-proof box we showed bolted to a porch in August 1934. A hole in the top permits the bottle to be set inside, and four strips of spring brass prevent its removal. The owner unlocks a panel to access the milk. Home-security technology evolved in PM's pages, from safes made of spare tyres to whole-house diagrams on burglar deterrence.

**QUICK
FIX**



- **PICK UP SLIVERS OF BROKEN GLASS WITH MOIST COTTON WOOL.** – MARCH 1949
- ◀ **USE AN ICE-CREAM-BAR STICK TO SMOOTH CAULK IN CORNERS.** – FEBRUARY 1963
- ◀ **NEST A BRICK CHISEL IN BROOM BRISTLES TO CONTAIN DUST FROM A STRIKE.** – APRIL 1984

*** Improved slides for heavy drawers**

The January 1970 issue showed how to re-use a bleach bottle to ease action on a heavily laden drawer. Cut 2 x 5 cm strips from a clean, empty bottle. Heat the plastic and fold its long side into a 5 mm lip. Mount the strips at the bottom front corners of the drawer frame. The drawer slides on the strips, reducing friction.

*** Keyhole guide**

"A particularly useful device for people who are forced to stay out late at night" appeared in the September 1914 issue: the key guide. A V-shaped strip of metal affixed to the door tapers to a point just above the keyhole. The key's tip slides along the metal to find the keyhole opening. "This simple device should prove very useful in places where it is impossible to illuminate the keyhole."

*** Sandbag clamps**

Use sandbags to help glue down irregular shapes, such as veneer, on uneven surfaces. – March 1983

*** Block that door**

To stop a door from swinging while working on its lock or knob hardware, our November 1948 issue suggested this: notch a block of wood to fit the edge of the door. Set the block on the floor, wedge the notch on to the door's edge, and step on the block.

*** Cupboard-rod stop**

"The last suit or garment generally takes a beating

GLOVEFUL O' TOOLS

An old glove can become a miniature tool belt with a few modifications, according to our January 1949 issue. Cut a slit in the cuff of the glove so a belt can pass through it. Then snip off the fingertips and thumb tip. Worn on a hip, the open fingertips can conveniently carry pliers and large screwdrivers.



• JANUARY •
1949

MORE!



in a crowded closet (cupboard)." To prevent this, wrap rubber bands around the rod a few centimetres from each end to form ridged stops for wire hangers. – January 1959

*** Roof-rack mount**

"Transporting a sheet of thin building material can be tricky, as the sheets flutter and flap when carried flat on a car's roof rack," we said in July 1982. The solution: set a thick plank on the roof rack, running the length of the car. Secure the sheets to the rack's side rails. Twist the plank so that it stands on its narrower edge. The plank will bow the sheets so they're rigid enough to withstand the wind.

- To make a clip-anywhere camera tripod, braze bolts on to the clamp body and fit tripod heads on to the bolts. – *May 1951*
- Use a C-clamp as a handle for a heavy bucket or drum. – *March 1961*
- To move large furniture, weld casters on to C-clamps and clip the clamps to the furniture legs. – *March 1949*
- When removing a brake calliper, first use a C-clamp to pinch off the brake hose to minimise fluid loss. – *June 2001*

C-Clamp Bonanza

1957

• FEBRUARY •

Tighten a C-clamp on to a ladder rail, our February 1957 issue said, to keep a hammer “safely at hand” when working up high.



* **Chuck-key clip**

To avoid losing track of a drill-press chuck key, mount a clothespeg to the press and clip the key in the peg's jaws. – *December 1955*

* **Two-step push stick**

“When you make a table saw's push stick – and there should always be one handy – cut two notches instead of one in the end.” The stepped stick end has one notch cut at 10 mm depth and a second notch cut to 5 mm. Flipping the stick allows either thickness of stock to be pushed safely and securely toward the blade. – *March 1962*

* **Doorknobs access rubbish bins**

Rubbish-bin lids still pose a problem that PM tried to solve in December 1946, when we suggested mounting two discarded doorknobs on each face of the bin's lid. The knobs act both as a handle and a hanger. Grab the knob on top to remove the lid, and use the knob on the underside to hook it over the bin's edge. This leaves both hands free to deal with rubbish.

* **Soap speeds screws**

Wood screws turn more easily in tight-fitting holes when threads are rubbed with a slightly wet bar of soap. – *September 1957*

* **Erudite craftsmen re-use old binders**

Fasten the metal portion of a three-ring binder to the top of a stepladder, we said in August 1972. Mount the binder so the rings face downward. Tools with holes drilled in their handles can be stored and replaced. When the ladder is to be moved, snap shut the rings, and tools will be securely held. The rings can also be used to hang cleaned brushes to dry.

* **Stop suffering from plywood blowout**

To prevent splintered edges as a saw blade exits plywood, press masking tape on to the back side of the cut, we said in May 1982. “The cut won't be absolutely clean, but it will be better than without tape.”

*** Lick envelopes with potatoes**

For readers burdened by correspondence, our November 1948 issue offered "one way to avoid the unpleasant task of licking postage stamps". The trick: moisten the stamps using a potato cut in half. The water in the potato activates the adhesive. Stamps today often adhere like stickers, but a spare spud can still be used to moisten a pile of envelope flaps.

*** Gloves pad ladders**

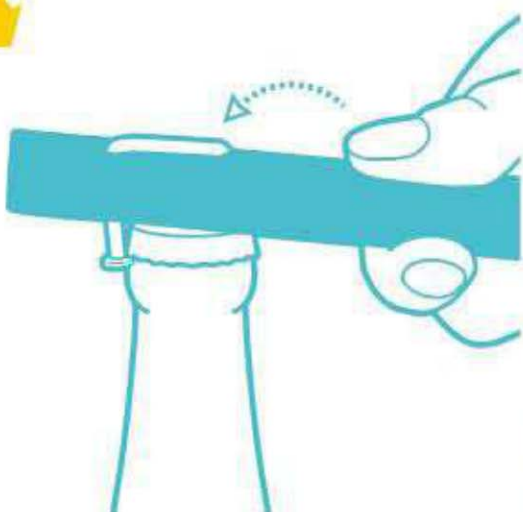
Fit cotton gloves atop ladder rails to prevent scratches where the ladder rests against paint or masonry. – March 1959

*** Tyre sled slides heavy stone**

Haul a heavy boulder out of a yard, our June 1951 issue suggested, by using an old tyre to make a sled. Use a bolt and nut to fasten two thick planks in a cross shape and wedge them inside the tyre. Drill a hole in one plank near the end. Loop and fasten a chain through the plank and around the tyre. Roll the stone on to the planks; hook the chain to a tractor or bakkie to tow away the sled. The stone rides above grade in the tyre opening while the tyre edge drags on the ground.

*** Thirst: the other Mother of Invention**

To quickly make a bottle opener, drive a nail into a board so the head stands proud by 10 cm. Bend the shank and grab the bottle by the nailhead. – March 1966



- ◀ GROOVE AN AXE HEAD TO AID CHOPPING. – AUGUST 1924
- POLISH METAL WITH A CLOTH DUSTED IN CHALK. – APRIL 1957
- SLIT A RADIATOR HOSE END TO EASE REMOVAL. – MAY 1990

STOUT-STRAP STOPPER

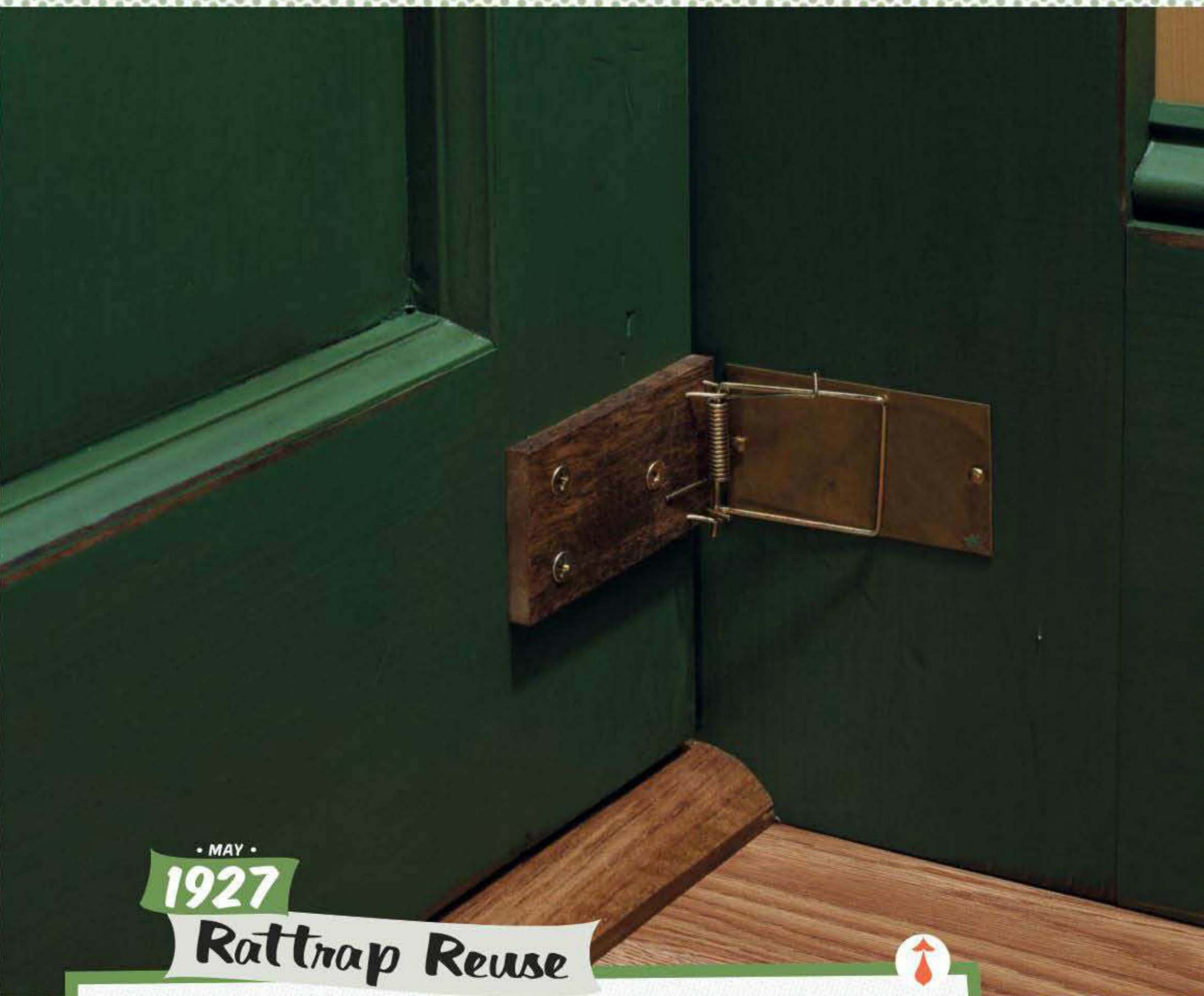
MORE!



On an incline, a hand trolley can roll backwards and cause an injury, our February 1938 issue cautioned. Reduce the risk by mounting stout fabric straps on the trolley's frame above the wheels. Move forward and the straps flap out of the way. Go backwards and the straps tuck under the wheels to arrest motion.



- USE A SINK PLUNGER TO PULL OUT A STUCK DRAWER WITH A MISSING KNOB. – FEBRUARY 1966
- STACK BRICKS IN A CYLINDRICAL SHAPE TO MAKE A VENTED LEAF-BURNING BIN. – APRIL 1947
- ◀ STROKE A PENCIL OVER A STICKY KEY'S SURFACE TO LUBRICATE IT (AND THE LOCK). – JULY 1926



• MAY •

1927

Rattrap Reuse

- Screw a trap to a trailer to hold a warning flag when towing large objects. – August 1932
- Mount several traps to a workshop wall to make a handy rack for gloves, notes and receipts. – May 1954
- Anchor one end of a long tape measure by clipping the tape in a nailed-down trap. – January 1938
- Retrieve dropped, unreachable tools with a trap dangling on a string. Hit the tool with the bait pan. – July 1961

"We had a door that we wanted to keep closed, and not having any suitable ready-made device at hand, we made one from a spring rat trap," we said in our May 1927 issue. Saw off the bait end of the trap and screw the remaining part to the door casing. Protect the adjacent surface with a piece of tin. "This door closer works perfectly, and is cheap."



**QUICK
FIX**



- CUT DISCS FROM WINE CORKS TO MAKE SLIDING FEET FOR CHAIRS. – MARCH 1963
- DRILL GUIDE HOLES IN A BLOCK TO STOP SCREWDRIVER SLIPS. – APRIL 1957
- SWAP FAT SAFETY PINS FOR MACHINES' MISSING COTTER PINS. – SEPTEMBER 1917

INTERIOR ORIENTATION

To locate identical positions on opposite sides of a wall, we showed a method using a bar magnet and pocket compass in October 1943. The magnet, attached to a suction cup, holds the position on one side of the wall. On the other side, a compass points to the magnet so the spot can be marked.

• OCTOBER •
1943



* **How to haul a saw**

It's tricky to protect a large push-style handsaw when transporting it along with sawhorses. Our November 1983 issue solved the problem. Cut a saw slot in each end of the sawhorse crosspiece. When finished using the saw, drop it in the slot.

* **Bucket stabiliser**

To prevent a bucket or other round container from sliding around on top of a bench while scouring the inside, our March 1934 issue said, lay the bucket on its side and wedge car tyre tubes beneath the curved exterior. (To update the tip, use bicycle inner tubes.)

* **New life for a broken broom**

A broken broomstick is just another new tool. In March 1981, we

showed how to shape a broken handle into a spike for digging holes for bulbs and seeds. A broken spade with a D-handle also works well. In July 1946, the broomstick entered the game room as a dart rack: plane a 20 cm length of broomstick so that it can be fastened to a backboard. Drill holes for the darts at a 45-degree angle; 3 mm in diameter, 13 mm deep, spaced 25 mm apart on centre.

* **A chisel manicure**

Because a dull wood chisel produces slipshod work, use a method we suggested in June 1948 to test the tool for adequate sharpness. Push the chisel cutting edge gently over the top of a thumbnail. If it slides without catching, the chisel needs to be sharpened.

* **Crescent as calliper**

To measure a drill bit to bore a pilot hole for a nut and bolt assembly, our August 1965 issue recommended using a shifting spanner as a crude calliper to determine the bolt's diameter. Then match the spanner jaw's reading with a corresponding drill-bit diameter.

* **Baste the brakes**

When replacing brake fluid, it's necessary to flush out the system. Don't do that by re-using the old muddy brown fluid in the reservoir, we said in November 1992. Rather use a turkey baster to siphon the excess fluid from the reservoir, then add a little clean fluid to flush out the reservoir. And don't use that baster on poultry ever again.

* **Sandpaper saver**

To unclog sandpaper, rinse it in lacquer thinners, then buff the paper with a wire brush.
– September 1954

QUICK FIX



- ◀ **HANG A FUNNEL ON THE WALL TO EASILY DISPENSE A SPOOL OF TWINE.** – AUGUST 1939
- **LINE GARDEN COLD FRAMES WITH ALUMINIUM FOIL TO CONCENTRATE HEAT.** – APRIL 1964
- **STORE A WET PAINTBRUSH OVERNIGHT IN TIGHTLY WRAPPED WAX PAPER.** – APRIL 1957

* **Better paper cuts**

We shared the secret to making neat cuts in large spools of paper in our March 1969 issue. With the spool standing vertically, unfurl the length of paper planned for use. Begin the cut a few centimetres from the top, slicing downward. The uncut section supports the sheet so it doesn't droop and tear. Snip off the top portion to finish the cut.

* **Fuel-spray stifler**

Servicing a fuel-injection system opens up lines with pressures that can top 4 bar, we warned in August 2002. "That's enough to spray atomised gasoline (petrol) across the shop." Here's how to protect your eyes: wrap a screwdriver shank in a shop towel and use the tip to depress the Schrader valve stem in the fuel rail's diagnostic fitting.



* **How to silence a clanking chain**

To prevent a chain from rattling, weave a rope in between the links, we said in June 1916. Arrange the rope so that it threads only in spaces between the links.

* **Defend the home with a putty knife**

To protect painted walls and other delicate surfaces when using a hammer to pull nails, wedge a putty knife beneath the tool's claw, our August 1954 issue recommended.



• MARCH •

1910

Bolt + Nuts = Wrench!

"If in need of a wrench and one is not at hand, take a large bolt and run on two nuts, allowing a space between them to fit over the nut to be turned," we said in March 1910. "This will make a serviceable wrench, a substitute that will prove very beneficial in case of an emergency."



• NOVEMBER •

1948

5 Uses for Hose



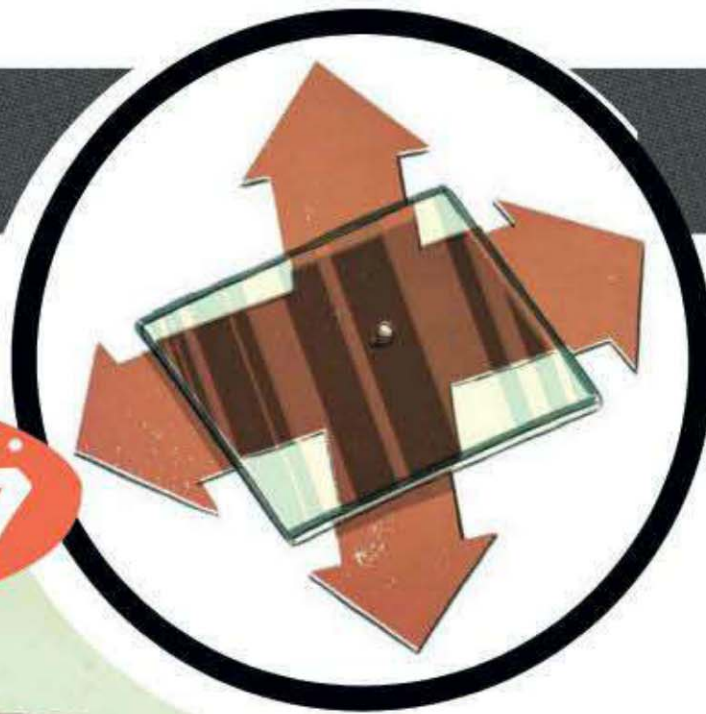
Scraps of garden hose just 15 cm long can hold hand tools, we noted in November 1948. Cut the hose to length with a small tab at the top to take a wall-mounting screw. “Using garden hose for this purpose is especially convenient for the man who does not want to build a cabinet.”



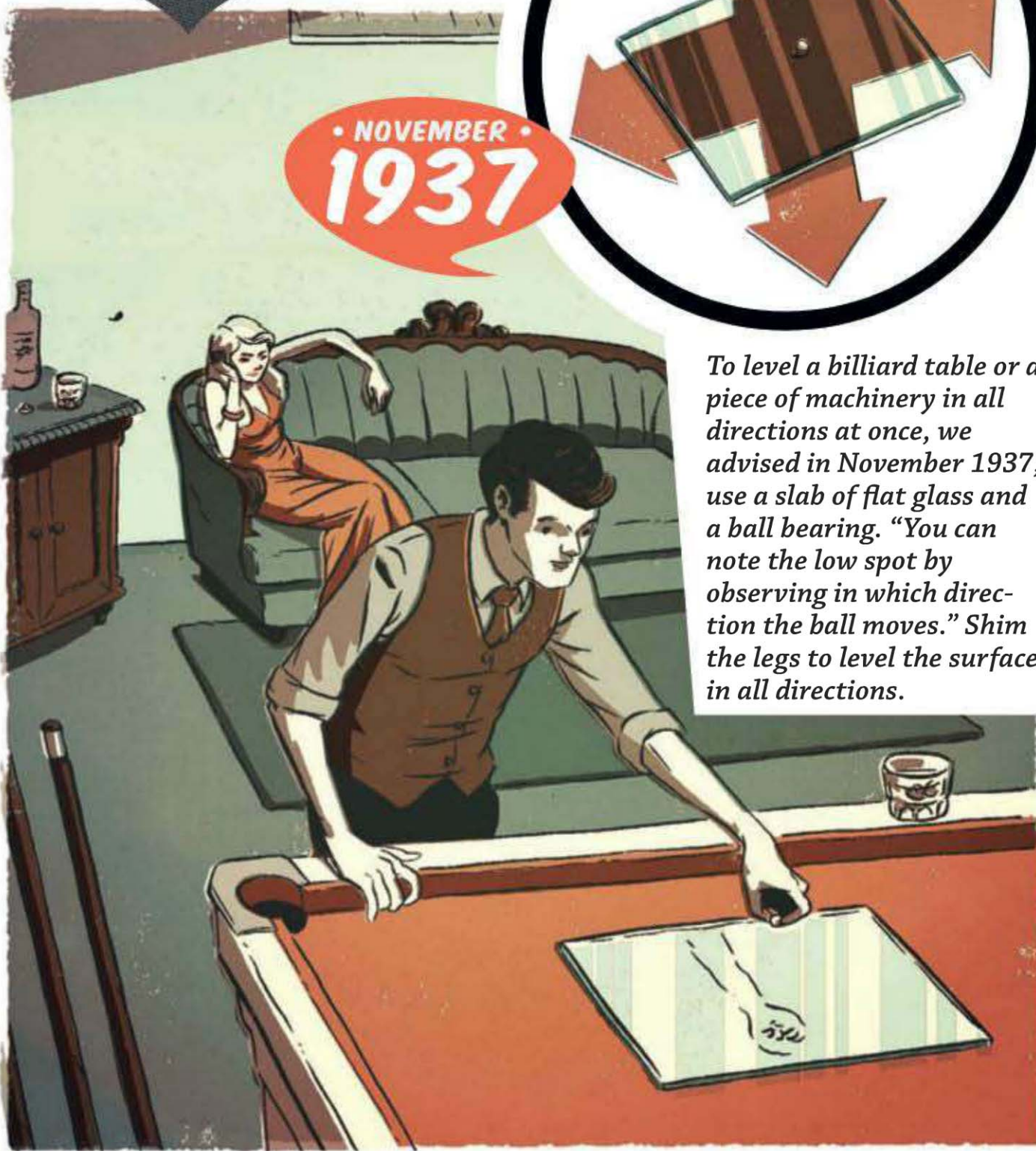
- ◀ USE A PUNCTURED COFFEE CAN TO SHIELD A BARE BASEMENT BULB. – JANUARY 1950
- PULL HEADLESS FINISH NAILS TIP-FIRST TO AVOID SPLITTING TIMBER. – APRIL 1963
- SAND A SQUEEGEE'S RUBBER TO RESTORE ITS WORN EDGE. – APRIL 1957

POOL-TABLE-TILT FIX

• NOVEMBER •
1937



To level a billiard table or a piece of machinery in all directions at once, we advised in November 1937, use a slab of flat glass and a ball bearing. "You can note the low spot by observing in which direction the ball moves." Shim the legs to level the surface in all directions.



MORE!

* Stop dropping those drawers

"No doubt you have pulled a drawer all the way out and – c-r-r-a-a-s-h!" Our December 1961 issue had a solution for drawers prone to pulling free of dressers: pull the drawer out as far as safely possible and paint a red stripe on each rail next to the cabinet face. Paint a black stripe 5 cm closer to the front of the drawer. Pull the drawer out no further than the black mark and you'll avoid spilling its load.

* Old bleach jug helps green thumb

Punch holes in the cap of a clean, empty bleach jug to make a garden watering can. – December 1962

* Glove pads make polishing easy

A pair of homemade mitts simplify and speed up the job of polishing a car, we said in July 1952. Stitch several thicknesses of terrycloth towelling or cheesecloth to a pair of cloth work gloves. Use one glove to apply the polish and the other to remove the excess. Wash them in soapy hot water.

* Ladder scraper for muddy boots

Our July 1958 issue had a tip for working safely on round ladder rungs in a muddy yard: mount a length of bar stock low on the ladder, then scrape mud off boot soles before climbing. Mount another rigid bar near the top of the ladder and you can use it to scrape goop off putty knives and trowels.

- ➔ Use hose lengths to protect a child's hands from swing-set chains. – May 1933
- ➔ Wrap a hose length in sandpaper to abrade concave and convex profiles. – February 1972
- ➔ Cut a hose strip to cushion the back of a hand saw. Press the blade into the work. – January 1954
- ➔ Wrap a cold chisel or a star drill in a hose length to make a shock-absorbing grip. – March 1937

Campsite Cabinet

"The camp hanger shown is easily made by attaching hooks to an old leather belt," we recommended in April 1921. For hardware, hang S-hooks or bend stout wire through holes punched in the leather. "The hanger will be found quite a convenience for clothing and utensils used around the camp."





• TO HIDE A SCRATCH IN WALNUT FINISH, RUB IT WITH A SLICED WALNUT. – OCTOBER 1954
◀ GIVE A HAMMER CLAW A FRESH BITE WITH A HACKSAW CUT. – NOVEMBER 1957

*** Bottle caps drain potted plants**

"When pebbles or ceramic fragments are not available for use as drainage material in the bottom of a flowerpot," we said in November 1956, "metal bottle caps make a good substitute." Place them with the crimped edge down to cover the entire bottom of the container.

*** News on windows**

Our April 2003 issue offered a glass-cleaning classic: use old newspapers to clean dirty windows. Save paper towels.

*** Padlock hardware**

A strap hinge taken from a barn door makes a hasp for a padlock. Remove the hinge pin and separate the halves. Fasten one hinge half to a doorframe, with the wide end of the strap mounted through to the frame, and the narrow end projecting outward. Fasten the other hinge half to the door itself, in the same orientation, so the holes align on the narrow, projecting ends. Insert the lock so its bar spans the holes. – November 1938

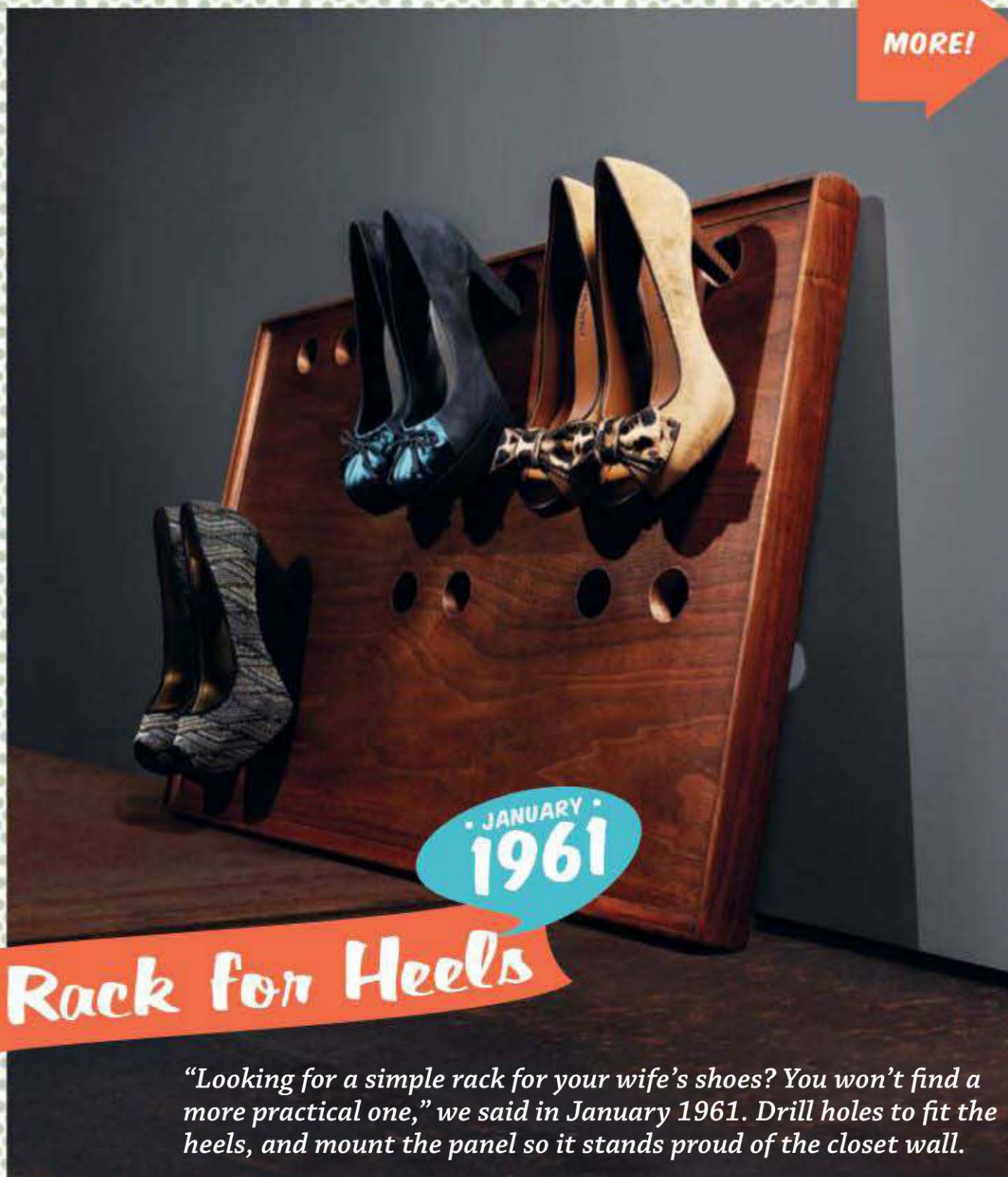
*** Milk carton ignites charcoal**

Use a cardboard milk carton to start charcoal for a grill, we said in May 1960. Cut off the top and stack the coals inside. The wax-coated carton will produce a hot flame around them.

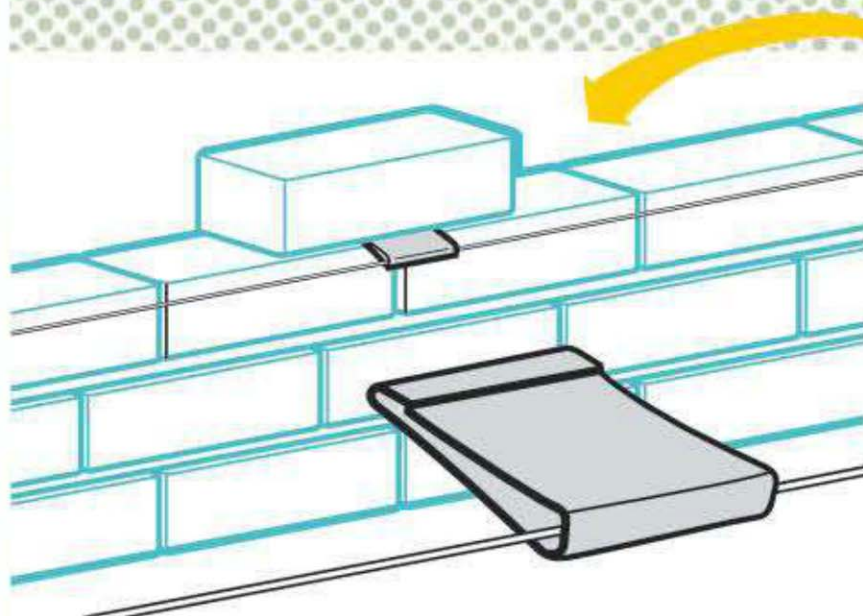
*** Training wheels for the shop**

Don't toss out training wheels when a child moves on to a bigger bike. Instead, mount the wheels to bench saws and other heavy workshop machinery. Attach the wheels above the floor and tilt the machines to move them around. – April 1972

MORE!



"Looking for a simple rack for your wife's shoes? You won't find a more practical one," we said in January 1961. Drill holes to fit the heels, and mount the panel so it stands proud of the closet wall.



*** Mason's helper**

"A matchbook held by a brick takes the sag out of a mason's line." The matchbook suspends the line, keeping it the right distance from the top course so it doesn't interfere with striking the mortared joint. – July 1962

*** Keep matches dry**

To waterproof matches, dip them in melted paraffin wax. – April 1916

**QUICK
FIX**

- ◀ **START BONFIRES WITH AN OIL-SOAKED CORN COB WEDGED IN A PIPE.** – JUNE 1949
- **MARK A GARDEN TROWEL HANDLE TO MAKE A SOIL-DEPTH GAUGE.** – JUNE 1954
- **USE OLIVE OIL TO LOOSEN PAPER ADHERED TO WOOD VARNISH.** – JANUARY 1950

Regrets...

we've had a few



Shirt-shredding washing machine

"Facing an accumulation of soiled clothing that would have cost at least \$10 if done at the laundry," a reader reasoned that his out-board motor could agitate suds. Mounted on a barrel divided by a screen, the rig worked, he claimed – for 10 cents. The clothing's condition afterward was not mentioned. – September 1926



FILTHY PLAYPEN

"When a playpen is needed and none is at hand, just take a kitchen or other small table, turn it upside down, and stretch cloth around the outside of the legs." The tip suggests padding the table's underside with an old comforter, but doesn't mention clearing out the cobwebs and chewing gum first. – February 1938

RAT TRAPS MURDER TURTLES

"Spring-type rat traps are an effective means of disposing of turtles which menace game fish in a pond or lake." An illustration shows a turtle about to bite a chicken head in a trap mounted to a post set in shallow water. Sorry, turtles. Our apologies to the chickens, too. – June 1948

BOOT LID MAKES USEFUL AWNING

"One home craftsman used the trunk (boot) lid of an old sedan to make a serviceable and inexpensive canopy for the back door of his home." The boot was dressed up, at least, with wrought-iron supports. – June 1954

* Five car fixes

The October 2009 issue gave "Get-Home-at-Any-Cost" tips for roadside catastrophes, beginning with a leak in the radiator. Crack a raw egg into the radiator filler cap (not the overflow tank). The egg white will plug the hole – for a while. To fill the radiator back up: top it off with water, diet cola, tea or any other sugar-free liquid.

To fix a punctured fuel tank: stuff a wedge from a bar of soap into the hole. It'll last long enough to get you into town. Oil sump punctured by a stone? Whittle a plug from a twig and hammer it into the hole. But now you're low on oil. To fill the crankcase, add a litre of water. Seriously. The oil-pump pickup is not on the exact bottom, and the remaining oil will float on top of the water.

* Shoehorn weeder

For weeding in the cracks of concrete, our June 1938 issue said, "a shoehorn is handy... it enables you to do the work quickly and prevents sore fingers". Good luck finding a spare shoehorn today. Those weeds can now be uprooted from tight cracks with an old putty knife or a painter's five-in-one tool.

* Fixing a hole

In the January 1963 issue, we recommended using a sliver snipped from a toothpaste tube to fill a stripped-out screw hole. Screw threads bite into the metal. With today's plastic tubes, a toothpick works better. But the essence of the tip remains: implements of oral hygiene can fill cavities.

PM

THE ★ END!



Taking up the design challenge

The growing consensus of the need for greener, more resource efficient ways of living makes this an era of exploration.

Energy efficiency and eco-friendliness are among the main considerations of forward-thinking consumers. They've become top of mind when building, decorating and revamping homes. It's up to us, the people with the know-how, to create solutions that enable them to achieve their green aspirations.

On the lighting front, we've got a head start. Innovation and advancements in energy efficient, long-lasting lighting technologies have ensured that there is now a low energy alternative for almost every lighting application.

There is still a lot of terrain to be charted as we merge good design with the energy efficient alternatives available to us. We've been given the reins: we just have to take them.

A smart mix of efficient lighting technologies and a clever approach to lighting design, installation and layout are necessary for practical, aesthetic and efficiency requirements to be in sync. Herein lies the opportunity to create, innovate and satisfy.

Take it further

Have you explored the terrain of energy efficient lighting? Do you have an idea for an energy efficient lighting technology, lamp, system or product?

Eskom is inviting designers, innovators, engineers and students to submit their energy efficient lighting innovations to the **Eskom Energy Efficient Lighting Design Competition 2012**.

The goal of the competition is to show that efficient lighting technologies can be used – and mixed and matched – in contemporary lighting designs and systems for homes.

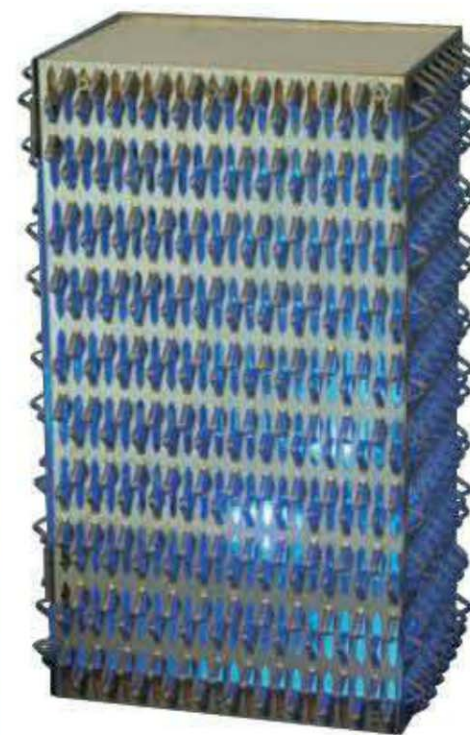
Since 1999, the biennial competition has helped mobilise transformation in the market, motivating lighting designers, architects and interior designers to use energy efficient lighting in their portfolios, and inspiring consumers to adopt innovative and green lighting concepts.

Participating and being honoured in the Eskom Energy Efficient Lighting Design programme is an accolade that entrants can leverage as a launch pad into energy efficient design and development in South Africa's increasingly eco-conscious residential sector.



Top: Winner of the Professional category Christopher Wood with his winning design, the Fissure Light.

Above: The King Protea Light by Jonathan Welch.



Above: The Pearly Blue Light designed by Ivan Pelsier.

Entrants can win their share of R214 000 and the chance to walk away with the prestigious Sparks Trophy. The deadline for entries is midnight on 31 August 2012. Full details are available at www.lighting-design.co.za or from Ruth Kolevsohn at ruth@silverroot.co.za

The competition is supported by Philips, the Radiant Group, LED Lighting SA, Voltex, Eurolux, ARB Electrical, OSRAM, the Department of Energy, the eta Awards, 49M, NEEA, NMISA, SESSA, IESSA, Technology Innovation Agency, the South African Institute of the Interior Design Professionals, Miss Earth, Electricity and Control, Sparks Electrical News, Vector, Lighting in Design and VISI magazine.

GREAT STUFF

COMPILED BY SEAN WOODS seanw@ramsaymedia.co.za

COOL LITTLE CRUISER →

If exorbitant fuel bills are getting you down and you're considering a small two-wheeled commuter, then you really must check out the Superlight 150 Big Boy Cruiser. Designed for lightweight cruiser fans who want the style and looks of a much bigger bike, it features a mellow 150 cm³ 4-stroke air-cooled motor coupled to a 5-speed gearbox, making it ideal for suburban cruising and daily commuting.

The motor pushes out 9,5 kW at 8 500 r/min, consuming a modest 3 litres/100 km and giving the bike a top speed of about 95 km/h. You also get front disc and rear drum brakes, and electric and kick-start options. Price: about R16 000. Contact Big Boy on 011-444 6017 or visit www.bigboyscooters.co.za



SEEING GREEN ↓

Thinking green is all very well, but how about *wearing* it? If you'd like your lifestyle to reflect your environmentally friendly ideology, then a pair of sunglasses from David Green's Leaf Collection range could be for you. Each precision-crafted pair incorporates a fallen leaf – dried, dyed and fashioned within a natural cotton-based acetate material – in its frame.

Oh, and the frame accommodates prescription lenses (you know, just in case you're one of those practical-oriented folk). Price: about R1 500. Contact Luxury Brands on 021-702 3436 or visit www.greeneyewear.com



SUCK, BLOW OR MULCH ↓

People with larger gardens know only too well how much work goes into keeping them tidy. When it comes to sprucing things up, McCulloch's GBV345 Blower-Vac is a winner: this three-in-one blower, vacuum and mulcher features a 45-litre collection capacity and a metal shredding blade to produce a 16:1 mulching ratio.

Features include finger-operated "cruise control", air purge technology (for easier starting), an effortless pull-start system, and an anti-vibration handle. Price: about R1 800. Contact McCulloch on 0860 048 759 or visit www.mcculloch.biz



DOUBLE TROUBLE →

What's the best way to double the output of your average torch? Give it dual heads, duh. The new Klarus XT20 Tactical Flashlight may be deceptively compact, but make no mistake – it's blindingly bright. Each of the two heads contains a high power CREE XM-L U2 LED with smooth reflector, allowing this impressive torch to pierce the darkness with a whopping 1 200 lumens from just two rechargeable batteries.

Featuring three brightness modes and one flashing mode, it uses the innovative XT series dual-button tail switch, which allows you to operate the light using only your thumb. It also features a tough aerospace-grade aluminium body with a hard-anodised anti-abrasive finish and toughened ultra-clear glass lenses. Heck, it's also waterproof down to 2 m, and if you absolutely must, you can mount it on a weapon; after all, it's a "tactical" torch. Price: about R1 630, or considerably less (R889) if you opt for the single-head – and only marginally less formidable – XT11 model. Contact Klarus SA on 071 613 6777 or visit www.klaruslight.co.za



*Editor's
choice*



LET THERE BE LIGHT ↓

Fact: power failures happen. This alone justifies the purchase of the rather neat Pharox solar battery charger. Then there's camping, a leisure activity that generally requires some form of illumination, if only to ensure that you've picked the right brand of beer from the cooler box. Anyway, this multi-function device comprises a detachable solar panel, connecting cord, an LED light with an integrated rechargeable battery and USB port, and a multi-tipped USB cable that allows you to charge most cellphones.

To charge the battery, simply place the unit in direct sunlight for a day. When it's fully charged, the battery provides about 45 hours of illumination. It alerts you when it requires a recharge, and the eyeball-light has three different settings: dim, medium and full. Price: about R350. Contact Lighting Warehouse on 0861 54 44 8464 or visit www.lightingwarehouse.co.za



JUST COOL IT ↓

You really don't want to fry your laptop simply because you forgot that it needs air to circulate and keep the processor cool. Here's one way to avoid this situation: Belkin's curved Laptop Cooling Stand uses a patented wave design to assist the natural airflow, pushing heat through a channel and away from the laptop, thus preventing it from overheating. Powered via a USB port and fitting comfortably inside a laptop bag, it's ideal for travellers. Plus, its sloping design raises your laptop's screen height, making it easier to type. Price: about R300. Contact distributors Tudortech on 021-424 2978 or visit www.tudortech.co.za





SNAPPER FOR ALL OCCASIONS ↑

Looking for a stylish compact camera to take along on your travels, to sports events or music concerts? Then Nikon's latest compact high-zoom snapper, the Coolpix S9300, is certainly worth a look. Hidden inside its slimline body (it measures 30,6 mm at its widest part) is a 16 MP back-illuminated CMOS sensor, a Nikkor 18x optical zoom lens (35 mm equivalent: 25-450 mm), full HD video capture, and lens-shift image stabilisation.

An innovative recording function allows you to shoot movie clips, pause, then continue filming, and the camera creates a single movie file for smooth playback. A built-in GPS allows you to geotag images or track your route when not taking photos. Auto HDR mode combines two shots taken at different exposures during a single shutter release to create an image with wide dynamic range and rich colour gradation. It also shoots up to seven shots at a fast six frames per second.

Other features include a 7,5 cm high resolution LCD screen, a 360/180 degree panorama mode, retouch menu, and the ability to wirelessly transfer still images directly to your phone or PC when using an Eye-Fi X2 card. Price: about R4 000. Contact Nikon on 0861 164 566 or visit www.nikon.co.za

PHOTO PRINTING MADE EASY →

Canon's latest compact photo printer, the Selphy CP810, is ideal for anyone who wants to print snaps with minimal fuss. It produces high-quality postcard- (148 x 100 mm), L (119 x 89 mm) and credit card- (86 x 54 mm) sized prints in under a minute. You can print directly from memory cards, PictBridge-compatible devices, flash drives or mobile phones via the integrated USB port without the need for a computer. Prints are dry and ready for handling the second they leave the printer. If your pictures are less than perfect, the Auto Image Optimiser function will make them look significantly better.

An optional NB-CP2L battery pack allows you to print on the move, and, to ensure that it's only portable when you want it to be, you can attach a Kensington lock. Price: about R1 000. Contact Canon on 011-265 4900 or visit www.canon.co.za



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MORE THAN A RADIO

Camping is undoubtedly good for the soul, but unless you're unnaturally serene by nature, you probably miss your cool gadgets. Eton's Solarlink FR650RDS multi-purpose outdoor radio, with its very cool and useful features, can help relieve those withdrawal symptoms. You get a radio, torch, emergency siren, flashing beacon and cellphone charger, and the good news is that the device uses any of four different power sources. You can charge it via a hand-cranked dynamo or integrated solar panel, access the mains via a USB adaptor (not included), or simply insert three AA batteries.

The digital tuner comes with AM, FM, shortwave and longwave bands as well as RDS (radio data system) display. The torch, comprising four white LEDs and one red LED, features a magnifying lens. All connection points are equipped with rubber gaskets or plugs to seal out moisture. The radio also features a digital clock with alarm, snooze and sleep timer functions. Price: about R1 250. Contact Mantality on 011-462 5482 or visit www.mantality.co.za

NEVER RUN OUT OF POWER

Having your gadgets die on you can be frustrating, inconvenient and occasionally embarrassing. With Energizer's Energi To Go XP2000K portable power travel kit at hand, it'll never happen. Equipped with a lithium polymer rechargeable battery, it provides power when you need it at home, in your car or on the go.

The kit features a zippered clamshell travel case, portable charger, USB charging cable, car charger, home wall charger (with two different plugs) and the following tips: Apple 30-pin, Nokia, Micro USB and Mini USB. Its battery provides up to 12 hours of extra talk time or 60 hours of extra music, and can maintain its charge for a year; "smart" LEDs indicate battery and charging status. It also comes with charge, temperature and short-circuit protection. Price: about R830. Contact Cape Union Mart on 0860 034 000 or visit www.capeunionmart.co.za



BOIL UP A STORM

There's nothing quite like a refreshing cuppa to revive flagging spirits when you've been roughing it. The Storm Kettle (Original) provides a distinctly retro yet effective way to boil water while you're "out there".

Here's how it works: you light a small fire in the detachable base, using newspaper or dry grass, and add some small twigs. Once the fire is going, you can add larger twigs, pine cones or even dried cattle dung to fuel the flame. The 1,5-litre aluminium kettle, featuring a double skin with a chimney in the centre, is then placed on the base. As the heat from the fire passes through the centre of the kettle, the water comes to the boil (it happens impressively quickly). If you need to add fuel, all you need do is pop it down the chimney. There's also a circular hole in the base that you can face into the wind to create extra draught. The kettle is imported from the UK by demand, so you'll need to allow 14 days for delivery. Price: about R1 100 (depending on the exchange rate). Contact iwarehouse on 0861 237 467 or visit www.iwarehouse.co.za PM



After a statement released by ER24 warning the public about serious medical risks when leaving their children in cars while parents go shopping, eNews Channel television journalist Serusha Govender decided to take it a step further.

Serusha explained to ER24 that we need to park a car in the sun and monitor the rise in temperatures inside the vehicle compared to outside. The results went beyond what all of us expected and it was clear that a child or an adult exposed to the extreme heat could suffer a serious medical condition.

Shortly after 10:00 on January 11th ER24 parked two vehicles in the parking lot of a shopping centre in Rosebank. With one vehicle being a control vehicle, the temperatures were monitored inside and outside. Initial readings indicated that outside temperature was 29 degrees Celsius and inside of the vehicle was a cool 19.4 degrees Celsius.

A test vehicle was left for 30 minutes and readings indicated that the outside temperature was 29.2 degrees Celsius and inside the vehicle quickly reached 36.1 degrees Celsius. After just one hour temperatures soared to a staggering 43.2 degrees Celsius.

During a brief discussion Serusha decided to climb into the vehicle and feel the heat. At 12:00 the temperature was 31.3 degrees Celsius outside and 57.3 degrees Celsius inside. After 15 minutes ER24 paramedics advised Serusha to climb out of the vehicle as temperatures continued to rise inside. Serusha, a young and healthy adult, explained to paramedics that she started to feel a bit dizzy and her hands started to shake, not to mention the severe sweating.

At 13:20 temperatures reached over 63 degrees Celsius in the vehicle.

The experiment proved just how dangerous it could be if you leave your child or pet in a vehicle while you go shopping.

Children will suffer more than adults. The reason for this is that their body surface is different to those of adults and their auto-regulation is not as effective as a healthy adult. Usually the effects will show much later in children but it will progress faster and be more severe.

Excessive exposure to heat may result in children suffering seizures or brain damage. If this condition is not corrected immediately the child can go into heat stroke or heat exhaustion and may result in death.

A motor vehicle is a metal box that can act as an oven when parked in direct sunlight or high temperatures. Extreme temperature can change a child's life in a matter of minutes.

ER24 Paramedics advise on the following:

- Under no circumstances should you leave your child (or pet) in a vehicle, even if a window is left open and you know you will only be away for a few minutes.
- Always make sure that your children have left the car with you when you arrive at your destination to avoid accidentally locking them inside of the vehicle.
- If you notice a child in a vehicle, immediately try to locate the parents or owner of the vehicle and contact the Police (10111) or Emergency Medical Services (084124). Taking immediate action could save the life of the child.
- Children that were successfully removed from a vehicle after being left unattended in the heat should undergo a medical examination in order to determine if they have any signs or symptoms of heat exhaustion or stroke.

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GO BROAD *or* GO HOME

South Africans are still playing catch-up when it comes to broadband – but whether our flavour is ADSL or 4G, wired or wireless, we simply can't get enough of the stuff.



IT'S BEEN A LITTLE OVER 20 YEARS since the Internet officially arrived in South Africa. In November 1991, Rhodes University made the first IP (Internet Protocol) connection with the USA.

Two years would pass before the Net spread to the rest of the country. Since then, connectivity has grown by leaps and bounds – mainly mobile, as service providers capitalised on the inability of Telkom to speedily and cheaply expand its creaking landline network to the masses. Yet today, barely 1 in 10 South Africans have Internet access. Even so, more than 60 per cent of Africa's Internet traffic originates right here in South Africa, and our total international bandwidth has passed 10 Gbps.

Regular "State of the Internet" reports such as those from global Net organisations Akamai, which handles tens of billions of daily Web interactions for bodies ranging from Audi and Fujitsu to the US Department of Defence and NASDAQ, show that South Korea leads the world in overall broadband speeds, with nearly three-quarters in the "high broadband" category above 5 Mbps. The country's average connection speed is 14 Mbps. The baseline for TV-quality video is regarded as 2 Mbps.

South Africa falls well short of that, with an average connection speed below 1 Mbps until the introduction of Cell C's fast 21 Mbps HSPA+ network.

It's been forecast that South Africa's Internet user base will reach 9 million by 2014. Out of our current total user base of about one-tenth of that, the proportion of those using wireless overtook fixed line broadband a few years ago, with iBurst



'Most people view paying for bandwidth like paying for insurance. They just keep on paying the same service provider, never changing.'



The costs of linking South Africa to the rest of the world are the big stumbling block in the way of broadband adoption, but with more connections on the way – Seacom's cable is shown here in various stages of being laid – and driven by increasing need for high-speed connections at home and in the classroom, there's every reason to be upbeat about the prospects of improved connectivity.



Broadband for all = boom times?

Cheap, fast broadband for all will turbocharge growth and investment, says Western Cape premier Helen Zille.

The province has announced plans to create the world's biggest mesh network in greater Cape Town. "By 2020, we aim to have connected every citizen in the metropolitan area to affordable broadband infrastructure at network speeds in excess of 100 Mbps, and all citizens in towns and villages to a broadband network. The project will involve a range of partners from business to telecommunications and government," she said in her 2012 State of the Province address.

Zille had noted previously that the World Bank estimated that every 10 per cent increase in high-speed Internet connections in developing countries resulted in a 1,3 per cent increase in economic growth." Cape Town's municipal fibre network programme involves 500 km of cabling. Linking dozens of municipal buildings to each other and the Internet at 16 Gbps, the network incorporates cutting-edge switching tech to facilitate virtually cost-free communications using voice over Internet protocol (VOIP).

and MyWireless taking up an increasing slice of the wireless action in addition to the cellphone networks.

Rand for rand the wireless options are more expensive than ADSL, but as competition stiffens and technologies improve in advance of the introduction of 4G (see "And then there was 4"), this becomes a more economic proposition. Cell C currently claims to lead the pack with its standard 21,1 Mbps service. However, in terms of overall coverage it does lag the likes of MTN and Vodacom whose 3G services range up to the 21,1 Mbps of HSDPA+. Telkom also offers a competitive service that's currently limited in reach.

Speeds have been creeping up, with ADSL from Telkom now available at 10 Mbps. But, of course, you pay for that need for speed. Fortunately, improving connectivity with the rest of the world has helped keep prices stable, if not drive them down.

Until two years ago we were limited to Telkom's SAT-3 cable; the arrival of the SEACOM cable and others has helped boost the uptake of broadband services. Today, four submarine communication cables connect South Africa to Europe and Asia: SAT-2, the SAT-3/WASC and SAFE combination, SEACOM and EASSy. Two more are in the pipeline, with one of them likely to route direct to the Americas.

NEED FOR SPEED

By far the biggest barrier to improved broadband access and speed in South Africa is cost. That's largely to do with our long distance from the world's Internet hot spots, necessitating massive investments in undersea cable infrastructure.

At the same time, there is pressure to make progress in this area. "A huge driver is Internet-connected entertainment," says Andrew Solomon, manager of the digital division of POPULAR MECHANICS' publishers RamsayMedia. As the man who heads one of the most active and innovative divisions of its kind – and a man with more than a passing interest in online gaming – Solomon knows what he is talking about.

"I am not talking about a geeky user tucked away in a dark room. I mean somebody in a fairly conventional domestic set-up, with high-def YouTube playing on the TV, or somebody with an Xbox or connected media centre."

The availability is not yet there, but the funding is being found. Up to now, South Africans have been trying to accomplish the things that the rest of the world takes for granted – on less bandwidth. In a

sense that has made us more tech-savvy than many others because we have had to explore ways of making do with our limited bandwidth.

"In the US, it is accepted that you have Wi-Fi, etc. There's no drawn-out thinking and tinkering. It is just a kind of magic, like electricity. You find your mother-in-law or your aunt will be wanting to know passwords to connect to services."

Cable service provider Seacom has pointed out that music sharing programs such as Apple's iTunes account for 60 per cent of all Internet traffic. For some, that has resulted in unheard of (by local standards) performance: Japanese homes get 160 Mbps connections to the home, and New York enjoys 50 Mbps, 1 000 TV chan-

And then there was 4

4G, also known as LTE (long-term evolution), is based on all-IP Internet telephony. The International Telecommunication Union has laid down requirements of 100 Mbps for high mobility communication (for example, trains and cars) and 1 Gbps for low mobility such as stationary users. The goal of LTE is to increase the capacity and speed of wireless data networks using new digital signal processing techniques. This is expected to further boost streamed multimedia, gaming, IP telephony and ultra-broadband Internet access. The fastest current 3G speed, HSPA+, provides 28 Mbps downstream and 22 Mbps upstream. Although it is only looking like 2014 for 4G in the mainstream, the new iPad will have 4G capabilities.

nels (including 350 HD) and free national calling for \$150 a month.

South Africans are still getting to that point. In the meantime, as more broadband options become available, Solomon says, users "get promiscuous" with bandwidth with acquisition.

"Most people view paying for bandwidth like paying for insurance. They just keep on paying the same service provider, never changing." Yet there are others, like a colleague, he says, "who does a lot of online gaming. He is constantly looking for the most economical option. Sometimes these people have more than one provider: these games chew up a massive amount of bandwidth." And this is certainly not a minority interest, either. Typical bandwidth requirements involve a minimum of 3 gigabytes a month.

"Generally speaking, we humans are like kids in a candy store: if there is more speed, we will use more. And we will find

more ways of using it – some of them ways that may not have been thought of at first."

Rising speeds resulting in increasing use prompted service providers to impose a limit – a cap – on use to keep bandwidth hogs in check. As broadband availability increased, some offered it uncapped. But, as Seacom notes, file sharing such as iTunes continues 24/7, collapsing the concept of bandwidth management control. At any rate, check the fine print of your contract to see if it mentions "reasonable use". "There's an invisible line that, once you cross it, they are quick to let you know that you are exceeding the bounds of reasonable use. They will soon clamp down if they reckon you are downloading movies to on-sell to the neighbours," says Solomon.

The thing is, some service providers have, in a way, encouraged enormous downloads. "For instance, 8a offers a contract whereby it's better for people to make big downloads in off-peak times, at night. Basically they can download while they sleep. So it's hard to say that people shouldn't take full advantage of this."

Bandwidth in South Africa is still expensive, but how do we compare? In regions such as the US and the UK, broadband is usually sold bundled with other services such as cable TV. The extra cost for broadband is then relatively low. But even if you separate it out, and sell it without those extra services, it still works out cheaper than South Africa. You'll also find that broadband costs are cheaper

where most Web sites are located, which just so happens to be North America and Europe.

So where are we headed with broadband?

Our Electronic Communications Act points the way to a converged future, with providers of new-generation value-added network services operating downstream from the Big 6 Internet access providers – SAIX (Telkom), Neotel, Verizon Business, The Internet Solution, MTN Network Solutions, DataPro and Posix Systems) increasingly being accepted.

"Well, to repeat my insurance analogy, we really should be shopping around more," Solomon says. "And the thing is, nowadays we can. Besides that, the Consumer Protection Act is on our side, too. It's possible to get out of contracts where before you couldn't." PM

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> COMPILED BY ANTHONY DOMAN > anthony@ramsaymedia.co.za

ASTON MARTIN V12 ZAGATO

HOMAGE TO A LEGEND

Scheduled for production later this year and due to be showcased at the Geneva Show, the flagship Aston Martin V12 Zagato channels the legendary DB4GT Zagato, appropriately enough in the 50th anniversary year of that classic.

Concept versions have wowed the show and competitive worlds alike (winner at Villa d'Este and double finishers at the Nürburgring 24-hour). Production will be limited to just 150. Building the V12 Zagato takes 2 000 man-hours, including marrying high-tech aluminium and carbon fibre to a handcrafted interior and upholstery. Painting alone takes about 100 hours.

Put in your orders now to ensure you secure one at the launch price of £330 000 (about R4 million) plus local taxes.





CHEVROLET TRAILBLAZER

MAKING TRACKS

Expect to see GM's Trailblazer sport-utility in South Africa before year-end. Prices and model line-up are not yet available, but GM has confirmed the 2012 launch date.

GM South Africa refers to the Trailblazer as a large SUV, though strictly speaking it falls into the midsize class. Previewed at the Dubai Motor Show last year and built in Thailand, the Trailblazer shares its architecture with the Chevrolet Colorado pick-up developed by GM of Brazil. It's aimed primarily at the Middle East and similar regions. According to GM, the third row of the rugged 7-seat SUV is "an authentic third row where people can sit comfortably for long trips".

The show vehicle featured an all-wheel-drive system powered by GM's new 2,8-litre turbodiesel engine with variable-geometry turbocharger.



DODGE JOURNEY

AT SIXES AND SEVENS

Those who value refinement and power over economy will find Dodge's 2012 Journey right up their street. The 206 kW 3,6-litre V6 that powers the Journey is the only six-cylinder in its market segment.

But that's not, of course, the end of the story. Chrysler's vans have long been renowned for their storage flexibility, and the Journey is no exception: the list runs to fold-flat front passenger seat, in-seat storage and second-row in-floor storage. In addition to that, it provides seating for seven.

The vehicle has been thoroughly reworked for 2012. Key features are a suspension redesign, new engine mated with a 6-speed auto box, and a host of new tech that includes Uconnect Touch media centre with 213 mm touchscreen display.

Price: from R320 990.



AUTO

INTEL

SRT All we know about the next Dodge Viper, except that it will be ludicrously fast and built in Detroit, is that it won't be a Dodge. It'll be the first vehicle of the new SRT brand and simply dubbed the SRT Viper. More SRT models will follow.

560°C The temperature at which GM bakes a coating of nitrogen and carbon on to brake rotors. The layer reduces surface rust, which lessens the chance of brake-disc shudder and increases rotor life. The new rotors are standard on a handful of new GM models.

HYUNDAI H1 MULTICAB

LOAD AND GO

A double cab with a canopy thrown in? That's the way Hyundai's marketing director Stanley Anderson sees the company's follow-up to its H1 9-seater bus and panel van. But is it just, after all, an answer in search of a question? Then again, Anderson may just have a point.

The "crew cab" segment averages about 50 sales a month, all of them diesels. Yet the company's research conducted among owners of double cabs, SUVs, MPVs shows that there's untapped potential – especially among individual buyers – for a vehicle that can carry people and cargo securely. And another thing: about 1 in 10 preferred a 6-seat configuration... which is exactly what Hyundai came up with. It is also the only petrol-engined offering (there's also a turbodiesel).

The H1 Multicab is actually quite pleasant to drive. The feel from the driver's seat is more of a big SUV than a big van, quite frankly; the ride is firm but absorbent and well controlled. Road and wind noise are not overly intrusive, and nor is the petrol four. We'd be interested to compare its performance with the diesel version's, though.

This is above all a practical vehicle. That vast cargo space could, for instance,

be well suited to the disabled market when used with a wheelchair ramp. The upper glassed section of the panel that divides the rear storage area from the seating area seems to be capable of being removed. Doing so would make it possible for disabled occupants of the "cargo" area to have access to the interior of the rest of the vehicle.

Similarly, Hyundai makes much of its

decision to opt for glass in the rear panels to avoid a blind spot and for safety. Besides, they say, it's easier to put a panel in and take the glass out than the other way around. The H1 also has side-opening doors – not a tailgate – and sliding side doors. Whereas the normal panel van has storage capacity of about 4 000 dm³, the H1 has 2 500.

HYUNDAI H1 MULTICAB

→ Prices: R279 900 (petrol), R339 900 (diesel)

ENGINE

2,4 petrol four; 126 kW

2,5 turbodiesel; 125 kW at 3 800 and 392 N.m at 2 000 r/min

BRAKES

ABS with EBD (plus stability control on diesel)

ECONOMY

(Diesel) 9,7 litres/100 km



SUBARU XV

CROSSING OVER

Designed to compete in the compact-crossover segment with vehicles like the Hyundai Tucson, Ford Escape and Honda CR-V, the XV is essentially a lifted Impreza. It sports more ground clearance (220 mm) and suspension travel, yet shares the Impreza's powertrain options – a 2,0-litre boxer four with either a 5-speed manual transmission or a CVT.

European markets started seeing the new model in January, and we drove Euro-spec versions around Florence and Tuscany. With only 110 kW on tap and wearing snow tyres for December driving, the XV wasn't thrilling despite the inspiring Mille Miglia mountain back roads, but it proved more than adequate for urban and freeway use.

The XV's strength is its standard all-wheel drive. But it also shares virtues of the new Impreza: improved build quality, fit and finish, fuel economy and interior room. Those will serve it well in the lately hyper-competitive segment. – Kevin Wilson



TRACTION TIME

FORD KUGA

Compact SUVs have become a particularly hot area to be involved in, if the waiting lists for many of the more popular models are anything to go by. It's an area where Ford has, until now, lacked a contender. Well, the all-wheel-drive Kuga – described by Ford as a medium SUV or crossover, by the way – ticks many of the boxes. It certainly looks the part.

It's admittedly a high-end version, brought in with a powerful 2,5 (read: not exactly thrifty) turbocharged 5-cylinder engine and all the trimmings. The impressive list of tech includes stability control, hill descent control, rollover mitigation and Bluetooth with voice control. And it's priced to match, starting at R375 000. "We see it as a halo product," is the word from Ford. That halo slipped ever so slightly when it was pointed out that this is, after all, a model due for replacement next year (though Ford officials were quick to respond: "The next Kuga is still a while off").

The 2012 Kuga is, nevertheless, part of a product revival that will see high-tech advances in the shape of the SYNC infotainment system and EcoBoost engines.

Driving the Kuga is much like driving a big, slightly higher version of the company's Focus compact. That is to say, it feels solid, poised and crisp; the refined, punchy 147 kW five provides ample overtaking urge, though the steering is on the light side.

On a brief off-road jaunt the Kuga showed that its intelligent all-wheel drive with rear-drive on demand was up to handling rutted, hilly farm tracks, not bottoming out even once. It was only when we tried to climb a tricky gravelly upslope that wheelspin forced us to consider an alternative route. Maximum approach angle of 21 degrees and a maximum departure angle of 25 degrees are reasonable given the Kuga's likely applications.

The Kuga is practical, too, with a split tailgate and underseat storage boosting the stowage options.



FORD KUGA

→ Base price R375 000

ENGINE

2,5 turbo five; 147 kW

TRANSMISSION

Auto five-speed

ECONOMY

10,3 litres/100 km overall

0-100

8,8 seconds

TECH INSIDE: Intelligent all-wheel drive. The Kuga's Haldex AWD system uses several inputs (including torque and speed of the engine, the throttle position, the steering wheel angle, yaw rate, braking system and the speeds of all four wheels) to activate a mechanical pump to transfer as much as 50 per cent of total torque output to the rear axle. The system is able to pre-charge from a standing start, sending up to 10 per cent to the rear, and responds to higher cornering forces and aggressive driving by adapting rear torque delivery, optimising handling and dynamics. In sharp low-speed corners, reducing torque to the rear wheels aids manoeuvring. When slowing down using engine braking in slippery conditions, there's a further party trick: in combination with Engine Drag torque Control (EDC) the system senses wheel slip at high engine speed in low gears and boosts engine torque output in response.

PORSCHE MACAN

TIGER, TIGER

The Indonesian word for tiger is the inspiration for Porsche's new Macan sport-utility (artist's impression below), which will go on sale next year. Producing the new car entails a new 500 million-euro factory and more than a thousand new jobs.



CHEVROLET CRUZE HATCH

HEADED FOR SA

The hatchback version of Chevrolet's Cruze (Chevy's global top-seller) will be joining its sedan stablemate locally in the second half of this year.

There's no word yet on engines or pricing, but the new 1,7-litre diesel could be a contender. On its existing markets the car is also available with a 2,0 turbodiesel, and 1,6- and 1,8-litre petrol engines. Boot capacity is a generous 413 dm³.



FIAT PUNTO

TOUGH COMPETITOR

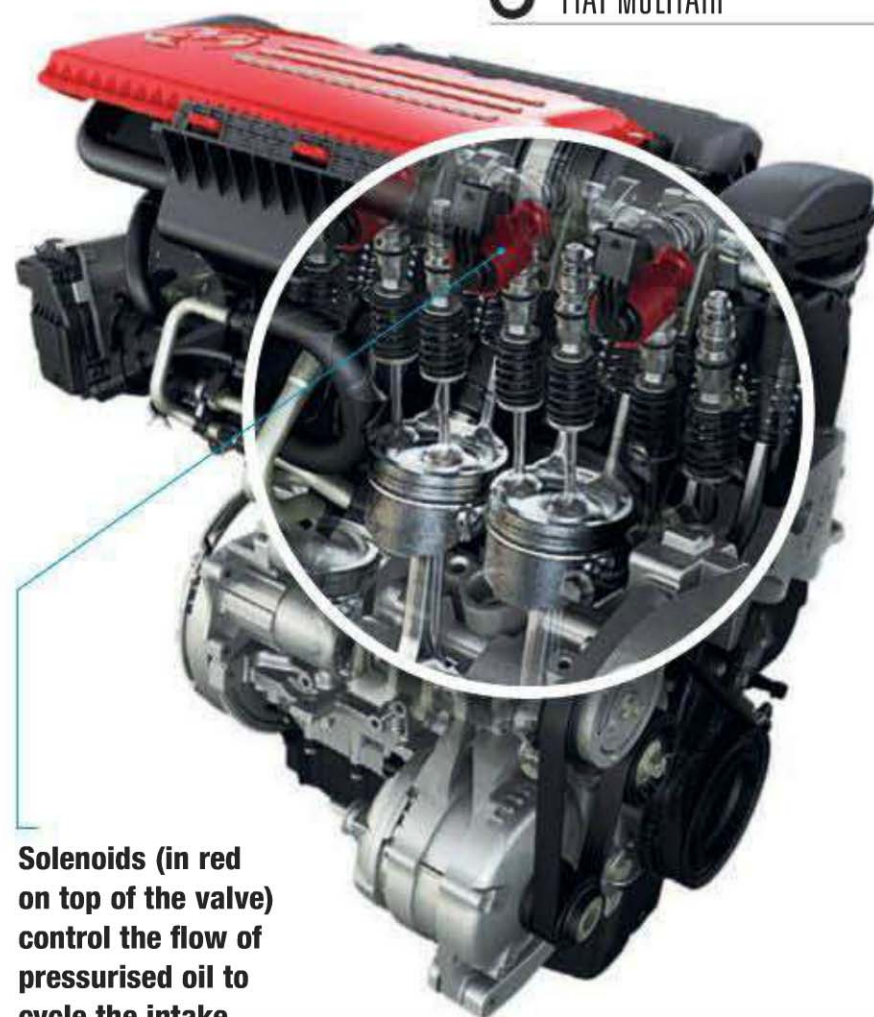
In South Africa, as elsewhere, the Punto is a bread-and-butter model for Fiat, selling nearly half of its total passenger vehicles locally.

Yet despite that, the new Punto sees some distinctive firsts. Significantly, the new model was launched concurrently with its Euro introduction.

Besides that, tech features not commonly seen on vehicles in this class include daytime running lights (upspec models get adaptive "cornering" lights), multiple connectivity options (picture, below) and Stop-Start, though only from mid-range models. Incidentally, versions with Stop-Start, which can be switched off, are fitted with a heavy-duty battery.

Pottering around the KwaZulu-Natal coast in the Punto, we enjoyed the refined ride and interior comfort. However, some dynamic aspects were less pleasing. For all its rated 77 kW output, the

version equipped with the normally aspirated MultiAir engine (right) seemed to lack oomph even down at the coast. It's also odd that this derivative is paired with a 6-speed transmission; the 99 kW turbo model gets a 5-speed. I was also left a little disappointed by the electrically assisted steering's lack of feel and feedback, though I must admit I was pleased by the ability to click in City mode for extra assistance while parking. The turbo more than makes up for its sibling's lacklustre performance, with the minor irritation of a mild vibration, possibly a harmonic, between 2 000 and 3 000 r/min. There are three models: a 1,4 FIRE producing 57 kW, the 77 kW MultiAir, and the 99 kW MultiAir turbo. Pricing is impressively competitive, starting at R129 900 all the way up to R209 900.



Solenoids (in red on top of the valve) control the flow of pressurised oil to cycle the intake valves.

TECH INSIDE: MultiAir. Engines are like people: The harder they work, the more air they need to breathe. When an engine is revved high, like when accelerating on the highway, its valves must open wide and for long durations. Conversely, at idle, that engine requires just a trickle of air to operate. Variable valve timing and lift systems continuously alter the way a valve operates, depending on engine speed and load, to increase fuel efficiency and power. These systems are becoming more common, but Fiat's MultiAir is the most novel. It operates the intake valves with a unique system: rather than using the cam lobe to press open the valve, the lobe pushes on the plunger of a tiny oil pump. The resultant pressure accumulates in a thimble-size chamber that feeds a computer-controlled solenoid (the valve "conductor"). When the solenoid is open, the oil pressure flows to the top of the valve, forcing it to open. The engine computer directs the solenoid and can vary the timing (when the valve opens in relation to the piston's movement), duration, and lift (how far the valve opens). With MultiAir, a tiny 1,4-litre engine produces a gutsy 77 kW and a healthy amount of low-rev torque. Also, since the system is simple and compact, it's not an expensive add-on. Additional material by Larry Webster. **PM**

FIAT PUNTO

→ Price starts at R129 900

ENGINE

1,4; 57 kW

1,4 MultiAir; 77 kW

1,4 MultiAir turbo; 99 kW

TRANSMISSION

5-speed (turbo) and 6-speed



AUTO

INTEL

3 The number of lines, according to Jaguar design chief Ian Callum, that define a car's shape. The three lines include the arc of the roof, and one from the top of each fender as the lines curve into the car's flank. Callum should know; he penned the stunning Jaguar C-X16.

Explore the **UNIVERSE** with **POPULAR MECHANICS**

JOIN OUR EXCLUSIVE GUIDED COACH TOUR TO SUTHERLAND AND THE FAMOUS STAR-GAZING MACHINE CALLED SALT OVER THE WEEKEND OF 18 TO 20 MAY 2012.

Fascinated by the bright lights that pepper our skies? Want to get up close and personal with the amazing Southern African Large Telescope (SALT)? Then join the **POPULAR MECHANICS** guided tour to SALT, via quaint Matjiesfontein and the chilly Karoo town of Sutherland, and learn how astronomers use this sophisticated instrument to explore the heavens and look back in time.

FRIDAY MAY 18TH

Depart by luxury coach from Cape Town on the N1 through the Huguenot Tunnel via Worcester, the Hex River Valley, De Doorns and Touws River. This scenic drive takes you through mountains and winelands, and the Little Karoo. Next up is Matjiesfontein, which is best described as an "eccentric British Victorian time warp". Visit its transport museum and explore the village on foot or step aboard an old London double-decker bus for a (very brief) tour hosted by the energetic "Johnnie", who will entertain you later the same evening at the piano in the Lord Milner Hotel bar. You'll have dinner at the hotel, after which you're off to bed to dream of stars and extraterrestrials.

SATURDAY MAY 19TH

You'll enjoy a leisurely breakfast and lunch at the hotel, with the morning

free to wander around Matjiesfontein and attend a fascinating lecture by an astronomer. (Feel free to ask difficult questions.)

After lunch, you'll board your coach to drive the 125 km to SALT, just outside Sutherland (in the Northern Cape). On arrival, we'll head straight to the observatory where, by special arrangement, you'll be taken on a three-hour afternoon tour, followed by stargazing until about 21h30. The return coach journey to Matjiesfontein should be quicker, we're told, because it's mostly downhill (!). You won't go hungry: we've arranged with the Lord Milner hotel to provide us with a packed dinner.

SUNDAY MAY 20TH

After a late breakfast at the hotel, the coach will depart for Cape Town, arriving about 13h00.



THE PRICE OF R2 390 A HEAD INCLUDES:

- Two nights' accommodation at the Lord Milner Hotel in Matjiesfontein, based on shared occupancy of a twin or double-bedded en-suite room (single-room supplement available).
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- Lunch on Saturday
- A packed dinner on Saturday
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CHOCKS AWAY

Emperor computer workstation

Billed as "the future of high-end home and office computer work environments", the scorpion-shaped Emperor 1510 workstation offers an array of features that enable the user to experience unprecedented comfort and quasi-total immersion through strategically positioned monitors, a powerful audio system, and all manner of useful accessories and functions (think LED lighting, tilting capability, and more). The result, as manufacturer MWE Lab tells it, is a complete computer office, ergonomically optimised, with a minimal-sized footprint that improves overall performance and productivity. This imposing piece of equipment was honoured in the International CES Innovations 2012 Design and Engineering Awards. It costs about R50 000 in the US.



VIDEO > Watch the Emperor 1510 workstation video on www.popularmechanics.co.za

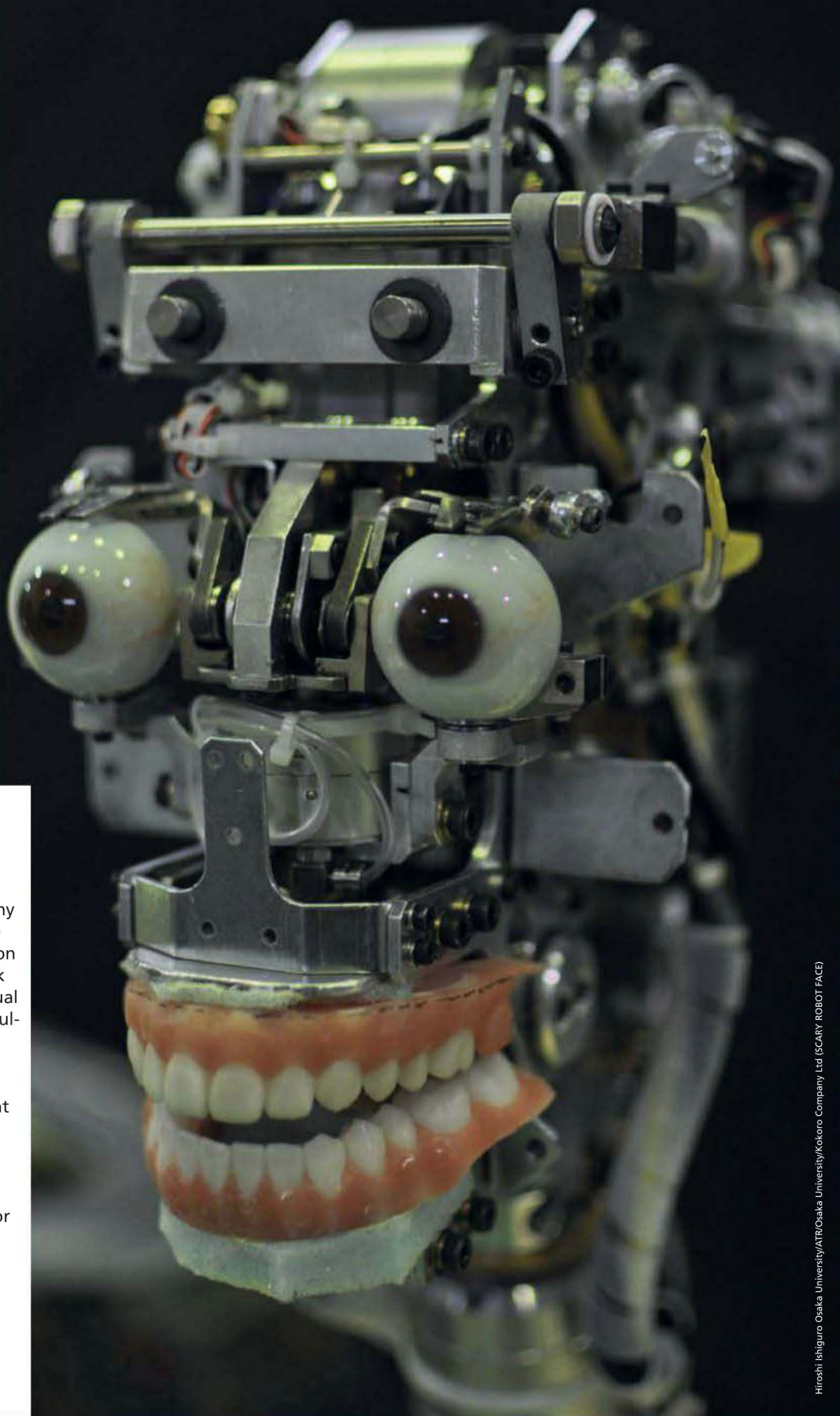
MY SUITCASE, MY SCOOTER

BOXX

If you've ever dreamed of owning a self-propelled suitcase (hey, who hasn't), there's a company in Portland, USA, that could make it come true. Say hello to the BOXX, a rather curious machine – actually, it's an electric scooter – that's said to deliver a top speed of 55 km/h, with a range of 130 km on a single charge.

Among its attractive features: the LightGuard virtual lane proximity system, which uses lasers to depict vehicle lanes, and lightweight hub motors. It costs about R30 000 (plus another four grand for a battery pack upgrade); the company is accepting advance orders for delivery in 2014. Oh, and it accommodates a couple of shopping bags.





REALITY CHECK?

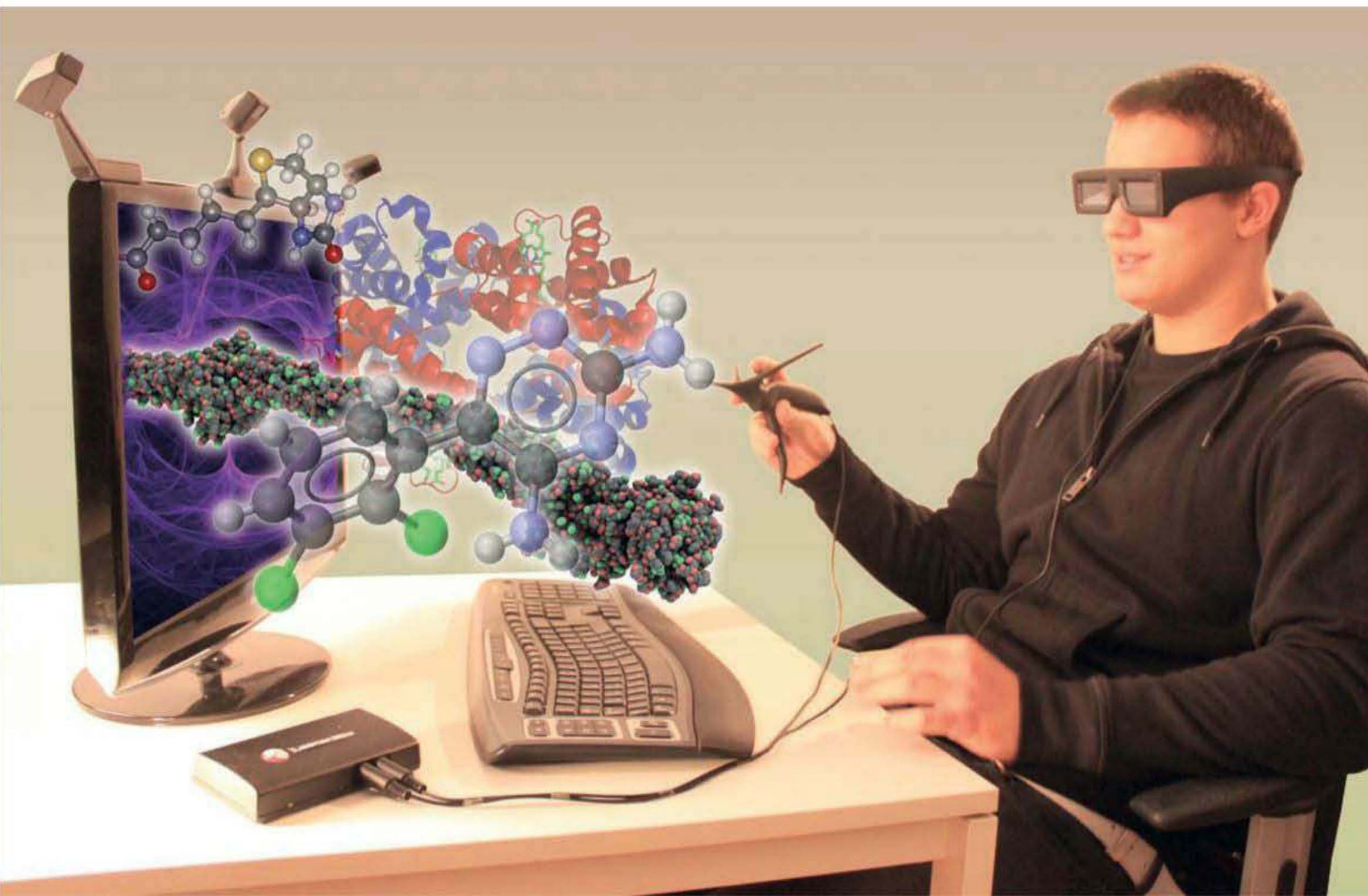
Geminoid-F

According to Wikipedia, the term "uncanny valley" is derived from a hypothesis in the field of robotics and 3D computer animation suggesting that when human replicas look and act almost, but not perfectly, like actual human beings, it prompts a feeling of revulsion among human observers.

Now meet Geminoid-F, a disturbingly lifelike robot that recently caused a stir with its appearance in a Tokyo department store window, where it interacted with passers-by. Programmed with upwards of 60 human-like actions, the robot even returned people's smiles. Geminoid-F is the creation of Osaka University's Professor Hiroshi Ishiguro, probably best known for designing and building Geminoid HI-1, a robotic replica of himself. The idea, as we understand it, was to test the reaction of shoppers to android mannequins.



VIDEO > Visit www.popularmechanics.co.za and come face-to-face with a robot from "uncanny alley".



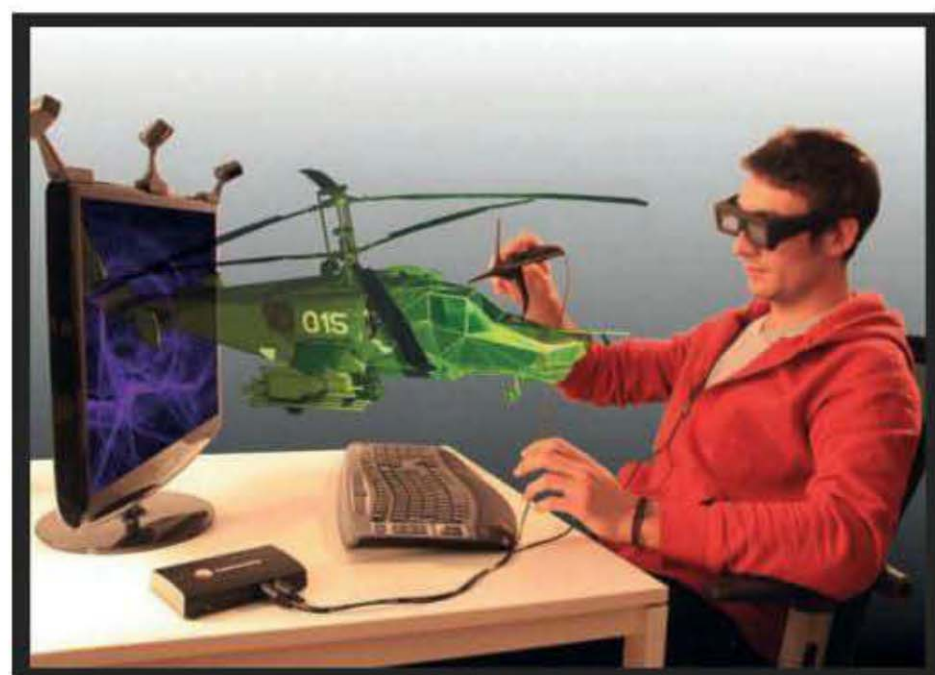
TOTAL IMMERSION

Leonar3Do desktop VR kit

We spent a few minutes watching people putting on goggles and pointing a weird-looking, vaguely bird-shaped device at a large monitor, somehow adding layers to a three-dimensional image of a monstrous creature that would do any sci-fi fan proud. Leonar3Do, we're told, is the easiest way to create and visualise virtual 3D objects in real space while sitting at your desktop (a teaser picture appeared in last month's "Editor's notes").

In short, it's an integrated software and hardware platform that offers an immersive VR experience in the sense that you are able to see and interact with your virtual objects in real 3D space. It comes in a kit that includes an installation DVD, VR goggles, motion sensors, and an input device called Bird. Hook these up to your PC, and you're ready to go.

Leonar3Do runs on Windows XP, Vista and Windows 7; Linux and Mac OS X apps are expected to follow. A software development kit allows developers to create new apps or connect any software. Dániel Rátai, founder of Leonar3Do, probably tells it best: "My aim and vision was to make virtual reality available for everyday use. Leo... provides a revolutionary new tool that enables us to interact with our visions in virtual reality." At a cost, naturally – about R8 000 in the US.



VIDEO > Visit www.popularmechanics.co.za to watch a video demonstration of Leonar3do technology at work.

THE SPRING THAT REVOLUTIONISED NASCAR

BY LARRY WEBSTER

PICTURE BY CHARLES MASTERS

TRAVIS ROAD IS ONE OF A HUNDRED DIRT LANES that road crews in this part of southeastern Michigan haven't got around to paving. On this late November day, a cold, steady rain has enlarged the potholes into craters that bounce my car as I approach a large, nondescript metal building. It's the kind of obscure facility that's sprinkled across the older suburbs of Michigan, Ohio, and the rest of the car-building belt of the Midwest. GM's Milford Proving Ground is 15 kilometres to the north, the border of Detroit 40 km to the south. A small sign outside says PSI Springs.

Inside is the guy everyone says I need to talk to, Steve Bown. He is tall, with wide shoulders and noticeably broad hands that make him look more like somebody involved in contact sport than someone who devotes his waking hours to the minute details of valve springs. He drops me off in the conference room and leaves to fetch his partner, Larry Luchi. And then I spot it on a dusty shelf: a heavy, slightly blackened coil mounted on a small piece of wood. A plaque underneath reads "Jeff Gordon, 1998 Rockingham Win". This tube of steel wire was the first PSI valve spring used in a Nascar race. It revolutionised engine building and the USA's most popular motorsport, but few people have ever heard of it.



This steel spring is 58 mm long and weighs 96 grams. Its unglamorous job is to keep an engine valve closed. It does that so well it kicked off a secret Nascar power war.



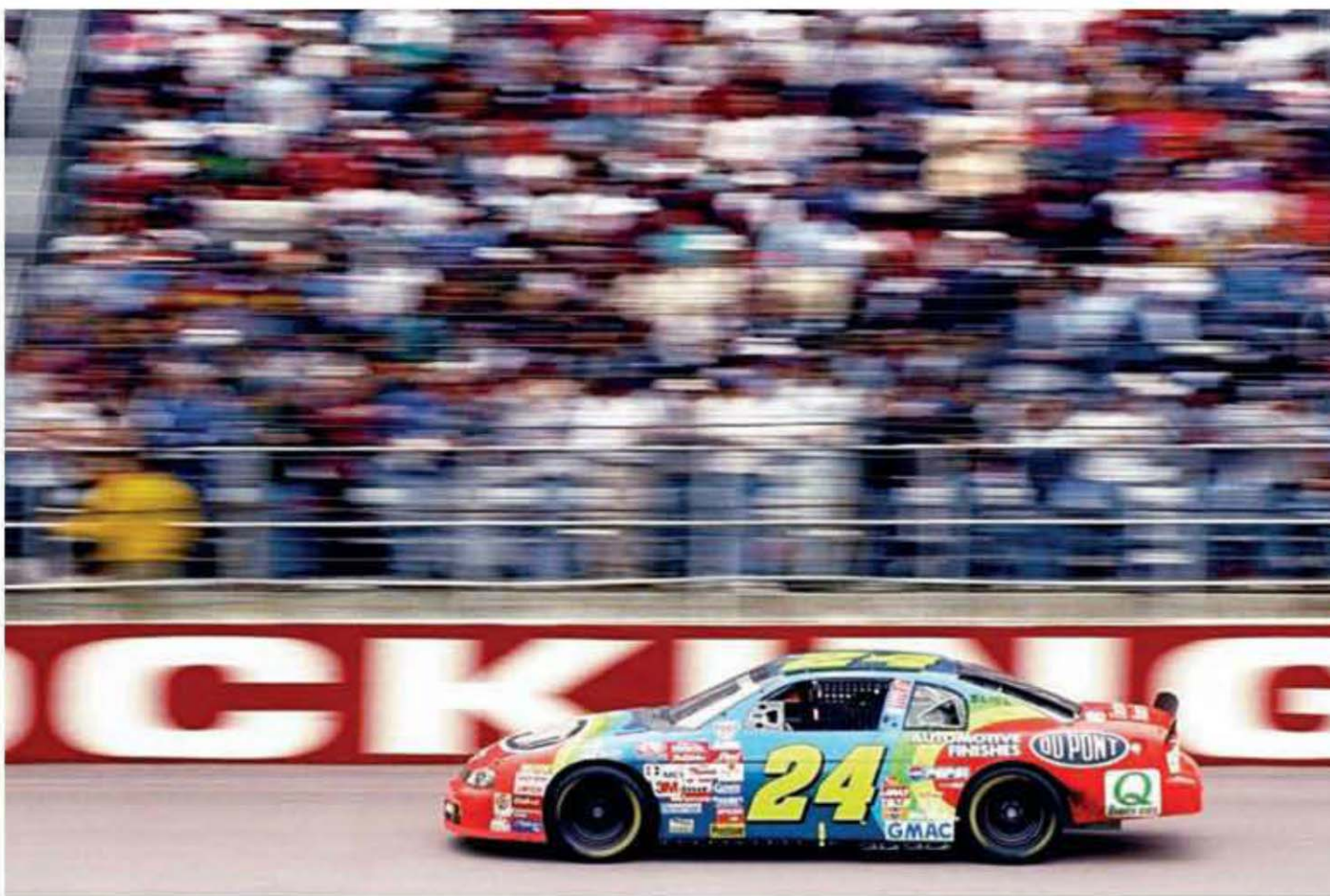
My interest in the subject began with a remark by legendary Nascar team owner Jack Roush. This was 15 years ago. I casually asked him if there was a single automotive part with the potential to dramatically alter racing stock cars. Roush isn't in the business of disclosing trade secrets, but he lit up. "Oh, yeah," he said enthusiastically. "Valve springs. We're getting higher quality valve springs that are going to let us do some tremendous things." It was an unexpected answer: these springs are humble engine parts. They simply keep the valves to the combustion chambers closed until the moment that a fresh dose of mixed fuel and air has to enter, or exhaust leave. Roush wouldn't elaborate – maybe he thought he had said too much already. Intrigued, I called other Nascar teams. But racers are as tight with their secrets as the security establishment. I got a bunch of "no comment" answers and moved on.

Recently, Nascar's big rules change for 2012 – a switch from carburetors to electronic fuel injection – made me wonder whether the innovations Roush hinted at had really changed the sport. I dug back into my contacts among Nascar team owners and engine builders. This time I was able to get people to talk.

The highly publicised switch to fuel injection was a sideshow, they told me, in comparison with the changes in engine performance that occurred between 1998 and 2004. During those years, power and engine revolutions had reached once-impossible heights. To understand how, I needed to ask Steve Bown about his valve springs.

Bown and Luchi return to the conference room, where I am contemplating the Jeff Gordon spring. "We were in the pits during the race," Luchi says. "Keeping our fingers crossed watching the 24 (Gordon's) car." It wasn't a particularly exciting race. Videos show Gordon hanging back for most of the contest, but clearly dominating the final third of the race. At one point he has a 4-second lead. Gordon had just won the 1997 Nascar championship, and fans had no reason to suspect that anything other than driving skill was at work. But Nascar engineers knew. Inside his engine, 16 newly designed valve springs were ticking away, giving him an advantage. "By 2001", Bown says, "all the teams were using our springs."

RULES GOVERNING NASCAR engine architecture date back 50 years. They have evolved, but the basic regulations that limit engine size to 358 cubic inches (5 867 cm³) and define the layout – two valves per cylinder and pushrod valvetrains – were written in 1968. For that reason, Mike Fisher, Nascar's managing director of research and development, has a strange job for someone with his title: keeping a lid on innovation. "We try to maintain a pretty tight box around what teams can do to the engine," he says. "We don't want one team having more power." If the details can seem backward, like running carburetors and burning leaded fuel decades after passenger cars had moved on, there's a certain genius to the strategy. Nascar grandstands are packed partly because, in any given race, there are at least a dozen drivers



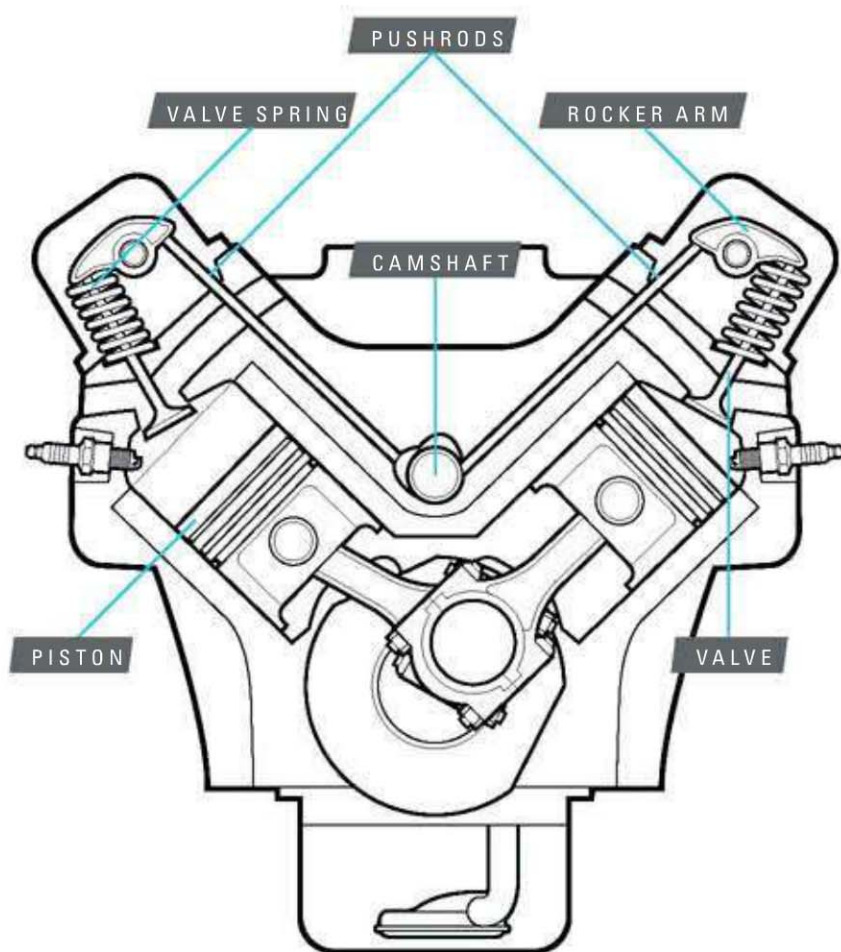
Jeff Gordon on his way to winning the 1998 GM Goodwrench Service Plus 400 at North Carolina's Rockingham Speedway. Few knew about the advanced valve springs inside his engine.

who could win. In terms of lead changes and tight racing, a Formula 1 race is, by comparison, a procession.

Despite the straitjacket rules, however, Nascar drivers, engineers, and mechanics have always hunted for ways – some legal, others not so much – to get a performance edge. Counterintuitively, massaging the old tech of the Nascar V8 at the granular level has produced highly advanced engineering. When it came to engine design, though, there was always one weak link. "The vast majority of engine failures – 85 to 90 per cent – are caused by broken valve springs," says Cecil Stevens, a longtime engine builder who now heads the engineering consulting firm Illusions Engine Development. The reason is simple: valve springs have an incredibly tough job.

At each of the engine's eight cylinders, the intake valve lets in fresh air and fuel, and the exhaust valve releases spent gases – 16 valves in total. A spring holds a valve closed until the valvetrain system pushes on the top of the spring, forcing the valve to open. Since an engine's output is directly related to the amount of air that flows in and out of the combustion chamber, the valves play a vital role. The larger the valves, and the farther they open, the greater the airflow and the power the engine can produce – and the greater the stress on the spring.

As much as airflow dictates engine power, so does the speed at which the engine operates. Spin an engine faster and it will, in most cases, make more power. Randy Dorton, the chief engine builder at Hendrick Motorsports, Gordon's team, started



PUSHROD-ACTUATED VALVES MAY SEEM OUTDATED – THE LAYOUT IS AS OLD AS THE INTERNAL COMBUSTION ENGINE – BUT REFINEMENTS TO THE DESIGN HAVE NEVER STOPPED COMING. GM AND CHRYSLER STILL BUILD PUSHROD ENGINES.

a quest in the early '90s to increase engine revs. Dorton died in a plane crash in 2004, but Jeff Andrews, who is now Hendrick's director of engine operations, has been at the team for about 20 years.

"Back then", Andrews says, "the biggest limiting factor (for higher engine revs) was the valve springs." In 1998, a stock car's V8 peaked at about 8 000 r/min. The valves cycle at half the speed of the engine's crankshaft, so at 8 000 r/min the valves open 4 000 times a minute, or 67 times each second. During many oval races, engines remain at peak revs for 800 kilometres – and the valve springs were operating outside their comfort zone.

The springs were a commodity product. Teams bought them from companies whose steady clients were mainstream carmakers. One such company is Peterson Spring, a privately held automotive supplier founded in Detroit in 1914. Dorton approached Peterson about building better valve springs. The company made some improvements, but it simply wasn't focused on racing. While there, Dorton met Peterson engineer Steve Bown and ultimately convinced him that there was a need for a company that focused on racing valve springs. Bown enlisted Larry Luchi, a former Peterson CFO, to handle the business details while he focused on design and manufacturing. In 1996, with about R1,3 million of start-up capital, the two men formed Performance Springs Inc (PSI). "During our first year, we had one customer," Luchi says, "Hendrick Motorsports."

Tractor tyre-size spools of steel wire squat in the rear of PSI's mini-factory. Bown guides me to a coiling machine that's about the size of a large refrigerator. Hydraulics draw the wire, and dies guide it into the spiral shape. When the spiral reaches a size dictated by computer controls, a cutter clips the wire and the newly born spring joins countless others in a bin. This first step in the process differs little from what you'd see in any other spring factory. What comes next is the unique part: PSI's 41 employees take the springs through a nearly 50-step treatment process, coddling the parts like diamond-cutters tending gems. "We focus on quality, not cost," Bown says.

One of PSI's main goals now is to increase the fatigue resistance by reducing the number and size of microscopic flaws in the metal.

When steel wire is coiled into a spring, the metal becomes rough, like a board cut on a table saw, although the flaws are all but invisible to the naked eye. PSI heats its springs to more than 500 degrees in an oven that looks like a giant toaster, quenches them back to room temperature, shot-peens them in three steps – the process is similar to sandblasting, but the medium is much finer – and polishes them. That's the quick version.

It took Bown an hour to walk me through the process, and he declined to divulge many of the details. The finished product is actually two concentric springs, a design that increases spring rate – the force required to compress it a given distance – while ensuring that the

piece can still fit in the allotted space. As a final step, workers in a darkened room inspect each spring under a microscope. If they find a blemish, it gets pitched. The rejection rate is about 25 per cent.

Engine builders have their own way of testing springs: they use a Spintron, a machine invented in 1993 by Bob Fox to test the pushrods made by his company, Trend Performance. It's a simple device, basically an engine block with only a dummy crankshaft and the valvetrain components – camshaft, pushrods, rocker arms, valves and springs. The engine doesn't run; it's cycled by a 45 kW electric motor connected to the crankshaft. With an array of sensors and high-speed video cameras, the Spintron reveals formerly invisible details, like how an undamped spring continues to oscillate after the valve closes.

In the win-at-all-cost culture of Nascar racing, where budgets hover at around R1,5 billion and winning the championship is a financial windfall, teams lined up to buy R450 000 Spintrons, which validated parts and became invaluable research tools. And few balked at the extra expense of the PSI springs – R220 apiece, or 40 per cent more than previous springs. But whereas the springs themselves weren't pricey, they unlocked a technological arms race that did prove expensive.

Once valve springs were no longer the limiting factor on engine revs, other weaknesses emerged. Doug Yates is the president of Roush Yates Racing Engines, a company that builds more than 500 Nascar engines a year. "Once you got a better valve spring,"

he says, "you could spin the engine faster. But for every extra 100 revs, the next weakest link showed up." Piston assemblies were lightened to lower the forces caused by the higher speeds. The camshaft was positioned higher in the block to reduce the length and the weight of the pushrods. Special coatings and bearings reduced friction.

In 1998, the best Nascar V8s revved to about 8 200 r/min and produced roughly 525 kW. In the following six years, the maximum engine speed climbed to

10 500 r/min and the power approached 700 kW. In the

process, the Nascar engine

builders broke through what were once thought to be ironclad boundaries.

Take piston speed, for example. It was once believed that the upper limit for the piston speed of a Nascar V8 was about 1 400 metres per minute. F1 engines, which are considered to be the most sophisticated racing engines, have piston speeds of about 1 600 metres per minute. But in 2004, the Nascar V8 outdid even the F1 motors with piston speeds of 1 645 metres per minute. "The F1 guys came over," Yates says, "and they couldn't believe what we'd done."

These changes weren't cheap. Say a team designs a new camshaft that opens the valve farther, to take advantage of the new springs. Testing the cam requires a new set of valve springs (R3 500), the camshaft (R24 000), valves (R24 000), and assorted other costly items, all adding up to about R80 000. To validate the test, it has to be repeated, so it's R200 000 for just one new part. If something fails, the part gets redesigned and the tests repeated. Now multiply that process over the hundreds of parts in an engine.

"It was a financial war to not only get an edge, but to simply keep up," Yates says. The result was to concentrate a significant horsepower advantage at the



Steve Bown (left) and Larry Luchi at their Michigan-based valve-spring factory. While the high-tech springs enabled Nascar V8s to produce over 700 kW, the business plan had modest origins: the pair formulated their strategy as they fixed up Luchi's lakeside cottage.

few shops that could afford to develop the high-revving engines. By the early 2000s, according to Andy Randolph, technical director at Earnhardt-Childress Racing Engines, the field was splitting between those teams that had engineered high-rev engines and those that hadn't. "The races were turning into rev battles," he says.

This rev race ended in 2005, when Nascar, concerned about maintaining a level playing field and limiting top speed, introduced the gear rule. By mandating specific gear ratios for each track and applying a little maths, race officials can compute the maximum engine revs. "It's the mechanical way to control engine revs," Nascar's Mike Fisher says. "We target about 9 000 to 9 200 r/min on a steady basis, with a peak of about 9 500."

The effects of that tumultuous six-year period are in plain view every Sunday. Today, engines are relatively unstressed, which is why failures are now rare. And where once more than a dozen shops and teams produced engines, now there are just a handful. For the moment, the field has been equalised: last year, there were 17 different winners, a 30 per cent increase over 2008.

At PSI, they're still testing and tweaking. Before I leave, Bown shows me the latest prototype. I hold it up next to the Jeff Gordon spring. The new one is half as thick. "We're getting steel made specifically for us," Bown says, "and the springs can withstand even higher stress levels." That means the engine builders can open the valves a little more, inching up the power levels again. So far, no team is using the new spring, but it's only a matter of time. There are rumours that some teams have found a way to increase engine revs past 9 500, despite the gear rule. They continue to experiment with aerodynamics, suspensions and tyres. And lap times drop a bit each year. **PM**

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NEWS BLOGS MULTIMEDIA SCIENCE TECH WHEELS DIY MAG GADGETS WIN SUBSCRIBE

VIDEOS



SKYDIVING FROM THE EDGE OF SPACE

The Red Bull Stratos team has announced that it is moving into the final preparation phase of the long-anticipated mission: Felix Baumgartner will undertake a stratospheric balloon flight to 36 576 metres and jump out, in the process attempting to break records for the highest manned balloon flight, the longest freefall duration, and the highest skydive.



WRATH OF THE TITANS

In *Wrath of the Titans*, Perseus (Sam Worthington) embarks on a treacherous quest into the underworld to rescue Zeus (Liam Neeson), who has been targeted for capture by his traitorous son, Ares (Edgar Ramirez), and his brother, Hades (Ralph Fiennes). *Wrath of the Titans* in 2D and 3D opens at cinemas on Friday, 30 March.



Check out both videos using the QR codes provided (if you don't own a tablet or smartphone, you can watch the videos on www.popularmechanics.co.za).

COMPETITIONS

Visit www.popularmechanics.co.za to enter our competitions:

Win a **Leatherman Sidekick**, personally engraved by company founder Tim Leatherman.



David Green has launched the “**Leaf**” sunglasses – real leaves are collected, dried, dyed and incorporated inside the frame with a “green” cotton-based acetate. We’re giving away a pair worth **R1 499**.



Win a new **Klarus XT20 Tactical Flashlight** (producing a formidable 1 200 lumens) worth **R1 630**.



Win **one of five Unbelievable Saws**, each worth **R300**.



Win **one of three SARS-compliant Travel Logbooks** valued at **R850** each.



Win **one of three Energizer battery hampers**, each worth **R1 000**.



YOUR TWEETS

@StianMouton: @popmechsa just had my Leatherman signed by Tim Leatherman! Stoked!! What a guy!

@thumbtribe: Advancements in science and tech - get the latest with @popmechsa and their mobi site! bit.ly/IGbpZU

@CiaraPicco: Like the header on the @popmechsa story on Yawning... “I’m not bored. My brain is hot.” #BestExcuse

@SaffaZimbo: My 5 year old is reading my @popmechsa - pure genius!

GAMING



Are you into gaming? PM's blogger, Andrew Solomon, plays and reviews all the latest games. Visit www.popularmechanics.co.za to find out what's hot, and what's not!



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DIGITAL CLINIC

> BY JOHN HERRMAN

Q+A



PAINT-SCRATCH
REMOVER



SCRATCHED
IPHONE 3G



CAR WAX



CERIUM OXIDE



BUFFING
WHEEL



SCREEN
POLISH



TOOTHPASTE

Screen-scratch surgery

Q My tablet slid off my lap and on to a concrete floor. Everything still works, but now the screen's acquired a bunch of scratches. Is there any way to fix this?

A I wasn't able to find a commercial product that claims to fix scratches on a glass touchscreen, but a Google search turned up a variety of improvised remedies. These run the gamut from fishy to believable, but have one thing in common: a near-total lack of substantiation. I decided to sacrifice a disused iPhone 3G for testing, a process that started with a pair of keys and ended, painfully, with a screwdriver.

One standout claim is that a coat of Turtle Wax will minimise scratches; in my testing, it did nothing of the sort, and left behind a thin film of wax, which attracted fingerprints. Others point to 3M scratch remover for cars as a possibility; three rigorous applications did nothing for the iPhone. Displex, a polish for plastic screens and another favourite among online DIYers, left the screen immaculately shiny and seemed to darken the appearance of scratches, but this was a temporary effect of lingering residue. I even scrubbed the screen with toothpaste until my arm was sore, which had no lasting effect.

There is, of course, an extreme option: glass buffing. With a small drill attachment and a tub of cerium oxide compound (and for deep scratches, some sandpaper), it is possible to grind scratches out of a screen, the same way you would buff scratches out of automotive glass. My testing indicates that this is a very bad idea. Glass grinding requires the steady application of wet-mixed cerium oxide, which is quite messy, and sprayed water, a natural enemy of all things electronic. I attempted to seal the phone with tape, but the sticky cerium slop found its way into almost every opening, drying like a fine cement.

As for the scratches, I was just starting to see improvement when I noticed a new type of blemish. My inconsistent water application had resulted in overheating, which destroyed an area of the underlying LCD. For a touchscreen device, glass grinding is, in other words, overkill, with an emphasis on "kill".

The best solution, short of screen replacement, is a screen-protector film. It won't just shield from future scratches – it will make some shallow ones invisible.

GIVE ME A SIGNAL

Q If I'm lost in the woods, should I climb to the top of a hill to get cell reception?

A Satellites play no role in cellphone reception, so getting closer to the sky, or getting a clear shot at it, won't necessarily result in a connection. Cellular reception largely depends on how close you are to a cell tower, what geographical and man-made obstructions stand in between, and how many people are using the tower at a particular time (more users decrease a tower's range).

That said, elevation can help. "It's hard to say that this is a hard and fast rule of thumb," says Brian Josef, assistant vice-president of regulatory affairs at the USA's Wireless Association, but climbing to get reception is "common sense". A higher elevation could put you in line of sight with a cell tower, which may help you get that one crucial bar of coverage.

This common sense applies only if coverage is a possibility; a truly remote location is not likely to have any service at all. By climbing to the top of a rock outcrop, especially during severe weather,

you're just exposing yourself to risk. If you're genuinely lost, focus on your situation, not your tech: gather water, build shelter, and stay put.

SUPER HI-RES

Q My phone has a 118 mm display with 720p resolution. My TV is 720p too, but it's 100 cm. Why don't TVs have much higher resolutions?

A Here's a quick back-of-the-napkin calculation: if a TV that size were as pixel-dense as a 720p smartphone, it would have a resolution of about 6 200 x 11 000 pixels – 6200p. Manufacturers are beginning to tease TVs with 4K displays (that's 3 840 x 2 160 pixels), but Raymond Soneira, president of DisplayMate Technologies, says that there isn't much to gain from a resolution race. For direct-view HDTVs, it's absolutely pointless to increase the resolution (beyond HD)," he says. "A phone is held at 25 or 30 cm, and a TV is typically viewed at least 2 metres away. At those distances the resolution, to your eye, is the same." And then there's the issue of price: the first 4K TVs will cost about R100 000.

PM

WHY PAY THROUGH YOUR NECK?

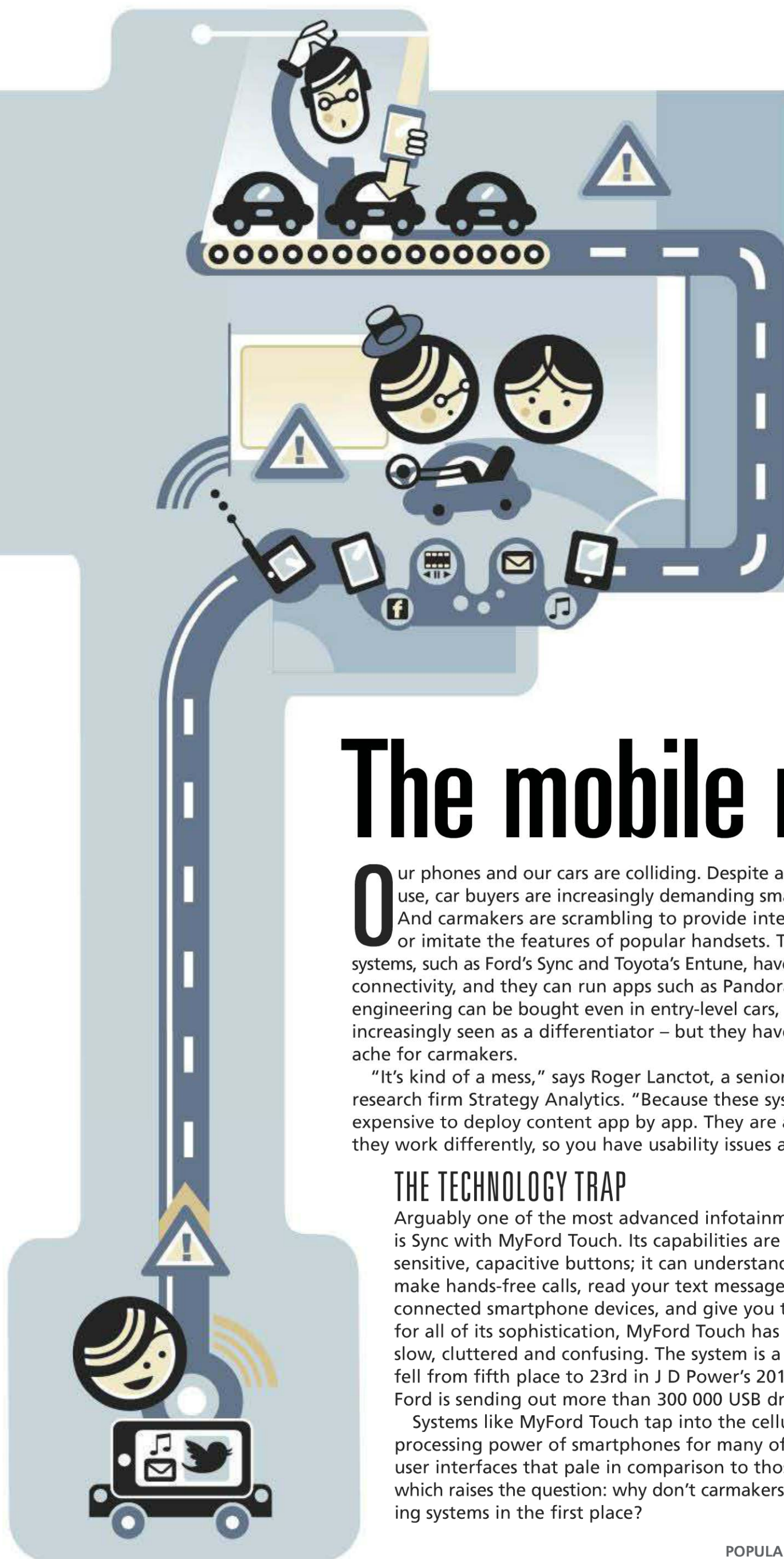
Personally, I love having money in my wallet.

Love it, love it, love it.



Tall Horse

A different take on wine.



With smartphone integration and Internet connectivity, car manufacturers are in unfamiliar territory – without a map.

> BY ANDREW DEL-COLLE

The mobile mess

Our phones and our cars are colliding. Despite a ban on in-car cellphone use, car buyers are increasingly demanding smartphone-style connectivity. And carmakers are scrambling to provide interactive systems that harness or imitate the features of popular handsets. These so-called infotainment systems, such as Ford's Sync and Toyota's Entune, have voice control and Internet connectivity, and they can run apps such as Pandora. In a world where quality engineering can be bought even in entry-level cars, infotainment systems are increasingly seen as a differentiator – but they have become a high-tech headache for carmakers.

"It's kind of a mess," says Roger Lancot, a senior analyst at technology research firm Strategy Analytics. "Because these systems are proprietary, it's expensive to deploy content app by app. They are also all brand-new, and they work differently, so you have usability issues and glitches galore."

THE TECHNOLOGY TRAP

Arguably one of the most advanced infotainment systems on the market is Sync with MyFord Touch. Its capabilities are formidable: it has touch-sensitive, capacitive buttons; it can understand complex voice commands, make hands-free calls, read your text messages to you, run Pandora from connected smartphone devices, and give you turn-by-turn navigation. But for all of its sophistication, MyFord Touch has been criticised for being slow, cluttered and confusing. The system is a big reason why Ford USA fell from fifth place to 23rd in J D Power's 2011 Initial Quality Study. Now Ford is sending out more than 300 000 USB drives to update it.

Systems like MyFord Touch tap into the cellular-connection and data-processing power of smartphones for many of their functions, but deliver user interfaces that pale in comparison to those of the phones. All of which raises the question: why don't carmakers just use the phone operating systems in the first place?



PHONING IT IN

As it turns out, there are systems in development that can, to a degree, port your smartphone's UI to your vehicle's screen. One such technology is Nokia's MirrorLink. Once the phone is connected to the car, MirrorLink essentially turns your dashboard display into a slightly modified version of your smartphone screen – as long as the phone and the vehicle display are MirrorLink-capable. MirrorLink has some big backers, including Toyota, General Motors, Nokia and LG and could start appearing in select vehicles and phones in the next couple of years, Lanctot says. But then again, it may not, since one company notably absent from the MirrorLink supporter list is Apple, the most influential smartphone-maker in the world.

But even if smartphones are superior to most factory-installed infotainment systems, that doesn't necessarily mean they are an ideal replacement. Andy Gryn is the automotive product manager at QNX, a software company that has provided the code for almost 30 million vehicles on the road. "You have an expectation of how an application behaves on your phone, with a small display and a ton of RAM," he says. "You're used to scrolling around through menus and pinching and zooming and all these things, and when you take that same display and replicate it in the car, the experience isn't the same."

Systems such as MirrorLink could exacerbate the nettlesome problem of driver distraction. When a carmaker creates its own interface, it can control the driving experience. But if the screen in the vehicle is essentially a pass-through to somebody else's software, that raises a big red liability flag.

So automakers will want to tightly control which apps and functions are allowed.

Still, using the phone's interface could free carmakers from some of the fast-paced burdens of software development. Vehicles generally take years to design, whereas smartphone operating systems and apps can be updated every few months.

CUE THE FUTURE

If MirrorLink is the answer, it's only a temporary one. According to Mike Hichme, engineering manager for Cadillac's Cue system, no car can be fully dependent on a phone. "(MirrorLink) is a feature; that's not the solution," he says. Automakers still need to design radio, HVAC and other basic vehicle controls. No car company is willing to just hand off fundamental parts of the driving experience to a phone.

Plus, it turns out that auto interfaces may be learning some smartphone tricks after all. Hichme's Cue system, set to premiere in three models later this year, can run HTML5, the same software language behind powerful Web apps such as Gmail. HTML5 should make it easier for developers to create apps that run across all platforms – which may ultimately neutralise the power struggle between smartphone and car. Still, HTML5 doesn't mean an app free-for-all. No one thinks playing Angry Birds in the car is wise.

Unfortunately for manufacturers, none of this makes the decisions any easier. If a car is just beginning the production process, there's no one answer and no knowing where the industry will be three or four years from now. "It's just painful to have to make these decisions when things are changing too damn fast," Lanctot says.

PM

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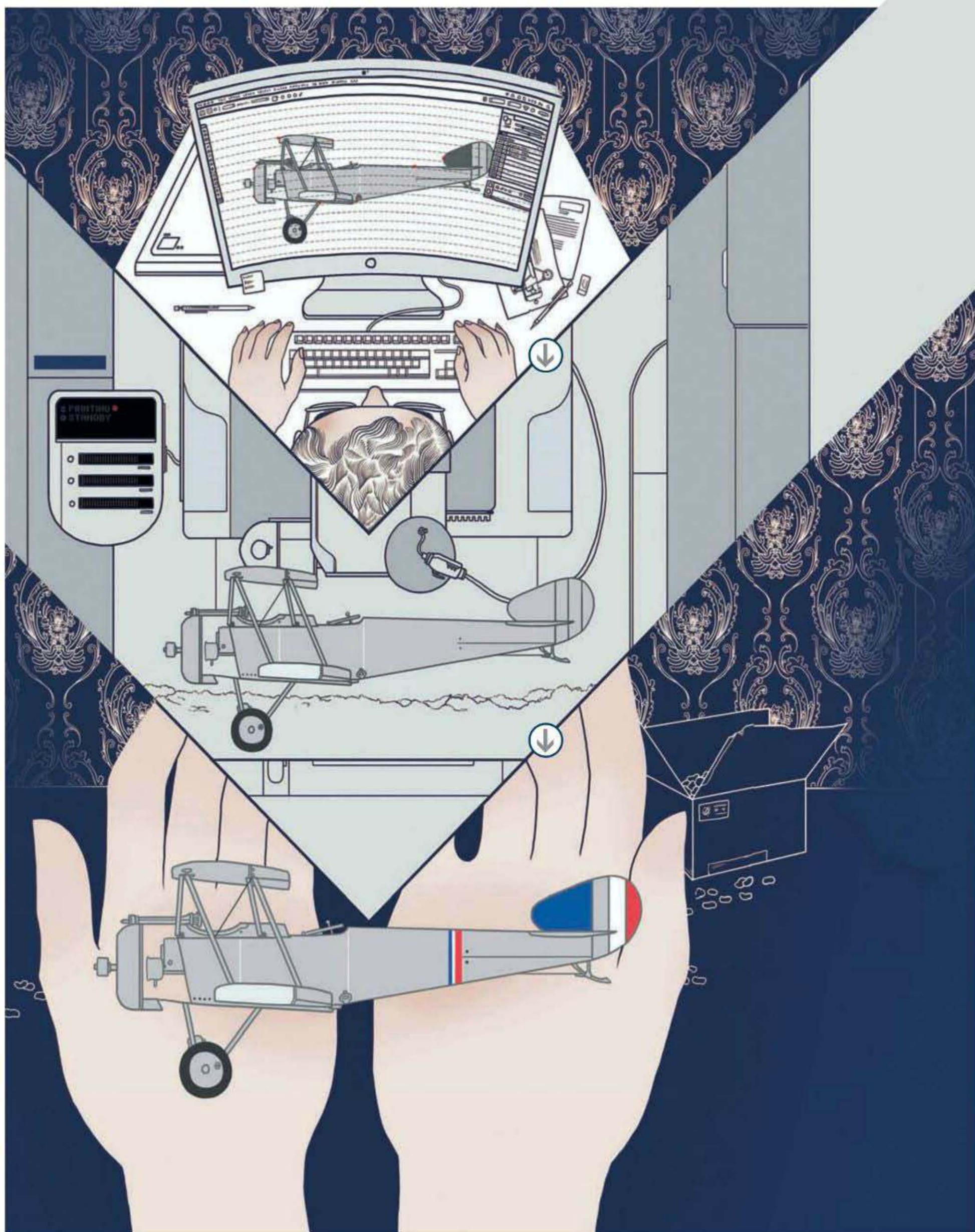
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Personal PROTOTYPING

If it's good enough for Boeing, it's good enough for you: 3D modelling (and printing) has come of age.

> BY JOHN HERRMAN

➔ **There was nothing wrong** with Stijn van der Linden's screwdriver set, save for one thing: years of use had worn away identifying marks from the handles. Tired of fumbling through a pile of tools every time he needed a No 2 Phillips, Van der Linden sat down at his computer. Using a PC program called 3ds Max, he created a complete 3D model of a labelled, ordered case, custom-fitted for his old tools.

When he was finished, he sent the file to his desktop prototyper, or 3D printer. About an hour later his tool case materialised in white ABS plastic. Everything fitted perfectly.

Van der Linden, an electrical engineer by training, is admittedly not a beginner: 3ds Max is a professional 3D tool used to create, among other things, computer graphics for Hollywood films such as *Iron Man* and *Avatar*, and his 3D printer, the pp3dp Up, retails in the US for nearly R20 000.

Nonetheless, he says, the appeal of DIY 3D modelling and printing is universal. "You're losing a lot of the limitations in the physical world," he says. "For my whole life, I always wanted to make stuff. Now I can make anything I want." It's true: an influx of easy-to-use software and on-demand printing services has made it possible for DIY-minded individuals – not just professional engineers – to render their designs, be they brand-new inventions or just hard-to-find replacement parts, in 3D and have them printed in plastic, glass or even metal. Here's how to get started.

3D for the masses

When most people think of 3D modelling, they think of CAD (short for computer-aided design). CAD conjures images of engineers toiling over green-on-black wireframes. This perception isn't entirely unfounded; 3D CAD modelling of the advanced, inscrutable sort has changed what it means to be an engineer and revolutionised everything from toy design to aviation. It has also been, until recently, almost completely inaccessible to ordinary civilians.

Today, though, 3D modelling has quietly opened to the mainstream. Free or

affordable tools have emerged that are designed with ordinary people in mind.

More importantly, these tools have found real, practical roles. Some, like traditional CAD programs, help people – tinkerers, inventors, artists – visualise objects in three dimensions. Others simply help you plan a new room in your home or reconfigure an old one.



Getting started

The biggest hurdle for would-be 3D-modellers isn't the price or the complexity of the software – it's the overabundance of options. There are pro-level modelling and rendering suites, finicky engineering tools, and simplified-to-the-point-of-uselessness art apps. In search of an entry point, I found an app called Tinkercad.

This free application runs inside a Web browser on nearly any PC or Mac and contains just the right level of functionality – it's capable enough for real 3D modelling, but not so complex as to put you off. It's a solid-modelling program – much like most professional CAD apps – which means that its models are an agglomeration of points in space rather than a hollow group of stitched-together polygons. With its emphasis on solid, volumetric materials, this type of modelling is particularly well suited for 3D printing, and Tinkercad has a button that creates a 3D-printer-ready file instantly.

To get started with Tinkercad, navigate to tinkercad.com and create a free user account. I was presented with a blank slate – or, in the parlance of 3D modelling, an open work plane. Building in Tinkercad is conceptually simple: in the Add mode, you select a shape – a box, a pyramid, a cone or a cylinder – along with a size. You then stamp this shape into 3D space; clicking and dragging will stretch the shape as far as you want. The Sub (for "subtract") mode lets you use the same shapes for object removal. One of the easiest practical projects is a shirt button: with the Add tool, stamp a disc that's 16 mm wide and 2 mm thick. With the Sub tool set at 3 mm wide and 2 mm thick, stamp out two buttonholes near the centre of the disc. That's it.

My first non-button project was admittedly a modest one: a *POPULAR MECHANICS* paperweight. It was to be about 100 mm wide, with a thick, 25 mm-deep base. Our

VERSUS	
	
A 3D model of the <i>POPULAR MECHANICS</i> paperweight, created in the online modelling app Tinkercad. FILE SIZE: 348 kilobytes	A sandstone rendering of the model. OBJECT MASS: 65 g

trademark PM lettering would be perched on top. (Swap for your initials if you want to follow along.)

Modelling a shirt button takes about 2 minutes; my paperweight took a great deal longer – about an hour, including 15 minutes to get used to the app and no small amount of trial and error. Getting used to the stamp-and-cut behaviour of the program was the biggest challenge; in its current incarnation, there's no way to move or resize an object – a block, for example – after it's been placed on the grid. Getting the spacing of the letters right took a few tries.

The core of the paperweight was composed of just seven shapes: one block for the base, four blocks for the M, and one block and a disc for the P. After creating the core, it was a matter of cutting, trimming, and adding accents. I subtracted small pieces of material from the middle of the M to match our iconic typography and carved out a hole for the P. I used small cubes to stamp serifs onto the letters and did cleanup with a 1 x 1-mm subtract tool. The end result was good enough. The next step was to make the paperweight real.

3D printing

POPULAR MECHANICS has devoted a fair number of pages in the past few years to a company called MakerBot, whose 3D printers can create small, plastic prototypes in just a few minutes – all they need is a healthy supply of ABS plastic and a 3D-model template from a program such as Tinkercad. MakerBot's machines are affordable, but only relatively: at upwards of R7 000, they're far cheaper than industrial prototyping machines, but out of reach for most hobbyists – including me. Plus, I was making a paperweight, and MakerBots print only in plastic. I wanted something with heft – glass or stone or even metal.

Fortunately for me, I'm situated in the US, where you'll find Shapeways, an on-demand 3D printing service. Sending my model to Shapeways was a two-step process: from Tinkercad I exported my project as an STL file, the industry standard for 3D printing; at *shapeways.com* I just clicked the Upload button on the front page. Ten minutes later, I got a message saying that my model had been approved, and I was presented with nearly 20 choices of materials. For R190, I could have the project printed in ceramic. For R7 000, I could have it cast in sterling silver. I made my selection (sandstone, R270) and I would have my paperweight within two weeks.

I've already chosen a follow-up project: ever the picky tech editor, I'm custom-designing a case for my smartphone.

(There is nothing as comprehensive as Shapeways in South Africa, in terms of the number of technologies in a one-stop operation. Institutions such as Vaal University of Technology and a host of OEM representatives/service providers do exist, though, basically offering all major the technologies available. Particularly worth mentioning is the Idea 2 Product lab initiative started at VUT, and which is in the process of being rolled out. This will possibly be the closest to the Shapeways model, at a competitive price.)

Advanced prototyping

Software for 3D modelling ranges in price from free to thousands of rand and varies hugely in complexity. Tinkercad is a fantastic starting point, but you'll hear a lot of other names when you dive into the world of 3D modelling.

SketchUp, by Google, is a popular program by virtue of its tie-in with the company's 3D-mapping program, Google Earth. (Google encourages users to populate its virtual maps with 3D replicas of real buildings.) Blender, another free program, is an open-source alternative to professional programs such as 3ds Max. It's versatile – there's really nothing you can't do in Blender – but it has a steep learning curve.

The app 123D, new from Autodesk, the company that makes the industry-standard professional CAD software, is a well-balanced tool kit for intermediate 3D modellers. Once you're comfortable in a program such as Tinkercad, you can find your way in 123D.

"Three-D modelling started as a hobby," says Van der Linden, but after launching a product line that includes kinetic toys, geometric sculpture, jewellery and desk lamps, it's quickly becoming a healthy source of income.

Roman Vasyliiev, a freelance designer, had been building model cars and planes for years before discovering 3D printing. His obsessively detailed World War I-era aircraft models now net a steady stream of income. (The top seller is a 1:44-scale model of the Caudron G.4, a French biplane bomber.) "I was really surprised that 3D modelling has become another branch of my hobby," he says, "and now, my work."

Modelling and printing in 3D has everyday applications, too. In an hour or two, Tinkercad or 123D can help you replace that once-irreplaceable knob on your priceless old guitar amp, for example. Last year a man named Duann Scott asked the manufacturer of his high-end baby stroller, Bugaboo, for a part to repair a broken hub lock. When the company said it would charge the equivalent of R2 000, he scoffed. Scott took apart the hub, figured out what he needed, modelled the parts on his own, and had them printed in stainless steel. Total cost: R100. PM



HOME IMPROVEMENT

3D RE-MODELLING

Half CAD tool, half video game, Autodesk Homestyler (*homestyler.com*) lets you visualise home-improvement plans in 3D. Virtual rooms can be furnished with products from companies including Kohler, KitchenAid and DuPont. You can then explore the finished room in real-time 3D, or export it as a photorealistic rendering.



WIN

one of three TW STEEL
special edition timepieces
Value: R9 950 each!

PERFECT TIMING MEETS F1 LEGEND

TW Steel launches the special edition David Coulthard watch from the CEO Tech collection.

Fifteen years at the pinnacle of motor racing brought home to David Coulthard the value of precision engineering and distinguished design. Now an insightful TV pundit and touring car pilot, the Scot raced with distinction in Formula One for Williams, McLaren-Mercedes and Red Bull Racing.

Appropriately, the 48 mm (CE4002) David Coulthard edition launches the elite new CEO Tech Collection from TW Steel, leaders in exclusive oversized timepieces.

The new model reflects Coulthard's passion for detail. At the same time, its bold, sophisticated look perfectly captures the luxurious associations with one of the world's most glamorous and appealing sports.

The CE4002 Model features sandblasted steel cases and a bezel that incorporates PVD dark titanium coating – also sandblasted for a richer finish – and a grey Italian leather strap that matches the red-accented grey dial. It features Sapphire Crystal glass, and is water resistant to 100 m.

For stockist enquiries call 011-448 2210 or visit www.twsteel.co.za and www.luxco.co.za

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To enter, answer the following question:

What type of Crystal glass is used on the David Coulthard special edition?

SMS: TWS, followed by the answer, your name and e-mail address to 32697 (R1,50 per SMS) or visit our Web site at www.popularmechanics.co.za. Competition closes 30 April 2012.

Popular Mechanics

TW STEEL
BIG IN OVERSIZED WATCHES



Rules: 1. Entry is open to anyone except employees (and their immediate families) of Ramsay Media, TW Steel and associated agencies. 2. Only one online entry per person. You may enter via SMS as many times as you like (SMS charged at R1,50). 3. Competition runs until 30 April 2012. 4. We will draw the winner(s) on 11 May 2012. 5. The prize is not redeemable for cash. 6. The judges' decision is final and no correspondence will be entered into. 7. Regrettably, only South African residents are eligible for prizes. 8. Prizes not claimed within 3 months will be forfeited.

Watches

Meet 2012's most stylish and advanced timepieces

OF NEW VINTAGE AND OLD BONES

Baselworld, the world's most important watch-making fair, has just wrapped up its week-long extravaganza – and what a show it was. From classical to futurist, from feminine to macho, from quartz to retro-mechanical, the timepieces on display provided a veritable anthology of techniques and styles. The “new vintage” approach is hot stuff right now, as are ultra-thin cases and automatic movements. The tourbillon remains intact, and the showcases are littered with finely crafted, highly readable dials that are frequently open-worked or “skeletonised” to reveal the watches' inner marvels.

With models displaying one, two or even three time zones and up to 24 cities as points of reference, it has never been so easy to travel. With each such metro-polis at our fingertips, one smooth gesture takes us whizzing around the world. Then there are the amazing materials... titanium, ceramics, carbon fibre, rubber, sapphire crystals, and more. Rarely has it been such a pleasure to check the time.



PIERRE DEROCHE TNT
ROYAL RETRO SAPPHIRE

Unveiling more mysteries

Three years ago, Pierre DeRoche introduced a world first with the launch of the TNT Royal Retro, with its six retrograde seconds mechanisms. Having made a significant impact with this watch, the brand is back – this time with seven visible sapphire bridges and an entirely transparent movement that unveils more of its mysteries. The association of sapphire and titanium, two extraordinarily hard materials, provides a compelling edge to personal timekeeping. Think sleek, masculine, sporty and every exclusive: it comes in an 11-piece limited edition.

> COOL FACTOR: ***



GIGA TOURBILLON
ROUND SKELETON

Wheels within wheels

This striking timepiece, with its classic round shape and skeletonised details, is fitted with a tourbillon measuring 20 mm in diameter and occupying half of the watch. Interestingly, the movement has been reversed, the bridges now placed on the dial side, the hours setting and winding section located on the case-back side, and the hours hand positioned on top of the minutes hand.

To ensure a 10-day power reserve, displayed at midday (traditional winding by the crown), the Giga Tourbillon has been equipped with four barrels instead of the usual one or two that characterise traditional tourbillons. These barrels, with a diameter of 16 mm, are 4 mm wider than the traditional design, providing the almost constant force required. In short, this watch plays very confidently in the complex domain of grandes complications.

> COOL FACTOR: **

Make no bones about it

Ernest Borel marks the occasion of its 155th birthday with a rather special collection, available in two versions for this anniversary. The steel version is limited to 550 pieces while the pink gold-plated version will make 1 000 people very happy. The ETA 2892 calibre beating inside this timepiece brings to life an elegant mechanism that has been entirely "skeletonised"

and finished with an extravagant Louis XIV decoration.

It comes with a stainless steel case plated with 10 microns of pink gold, 11 diamond hour markers, gilded luminescent hands, anti-reflective sapphire crystals front and back, and a brown alligator-skin strap.

> COOL FACTOR: ***

ERNEST BOREL ROYAL COLLECTION 155TH ANNIVERSARY SKELETON LIMITED



HARRY WINSTON HISTOIRE DE TOURBILLON 3

Pick a dial, any dial

Act 3 in the Histoire de Tourbillon leaves no doubt as to the visionary path taken by this collection, launched by Harry Winston in 2009. Proposed as a 20-piece limited series, Histoire de Tourbillon 3 draws the eye into the meanders of the perpetually rotating mechanisms, framed by a case in white gold and Zaliium (a mildly silly name used to describe an alloy of aluminium and zirconium).

At 9 o'clock is the bi-axial double tourbillon whose outer cage makes a complete revolution in 120 seconds, whereas the inner cage makes its revolution in 40 seconds. At 6 o'clock, a single-axis tourbillon rotates in 36 seconds. The off-centre hours and minutes are displayed on two rotating discs, while seconds regularly tick by. The third zone is for the power-reserve indicator, on a disc set with sapphires and citrines. The hand-wound movement features 479 parts and a 50-hour power reserve. Oh, and you get a black alligator-skin strap.

> COOL FACTOR: ****



HYT H1

When time is fluid

This is what happens when *haute horlogerie* meets fluid mechanics. As one of the two reservoirs at 6 o'clock compresses, the other expands (and vice versa) to push the fluids they contain through the tube. As the hours pass, the luminescent liquid advances. The half-moon meniscus marks the point where the two fluids meet to indicate the hour. At 6 pm, it returns to its initial position in a retrograde movement. How cool is that?

A 5 mm sapphire crystal, sculpted from a single block, accentuates this watch's three-dimensional architecture. The upper part of the watch is a "destructured geometry" of superpositions and reliefs, with a small seconds counter (it overlaps the minute regulator in the centre) that resembles a water wheel. The hand-wound movement, featuring rhodium-plated pistons, does its thing at 28 800 vibrations per hour (we wouldn't expect anything less).

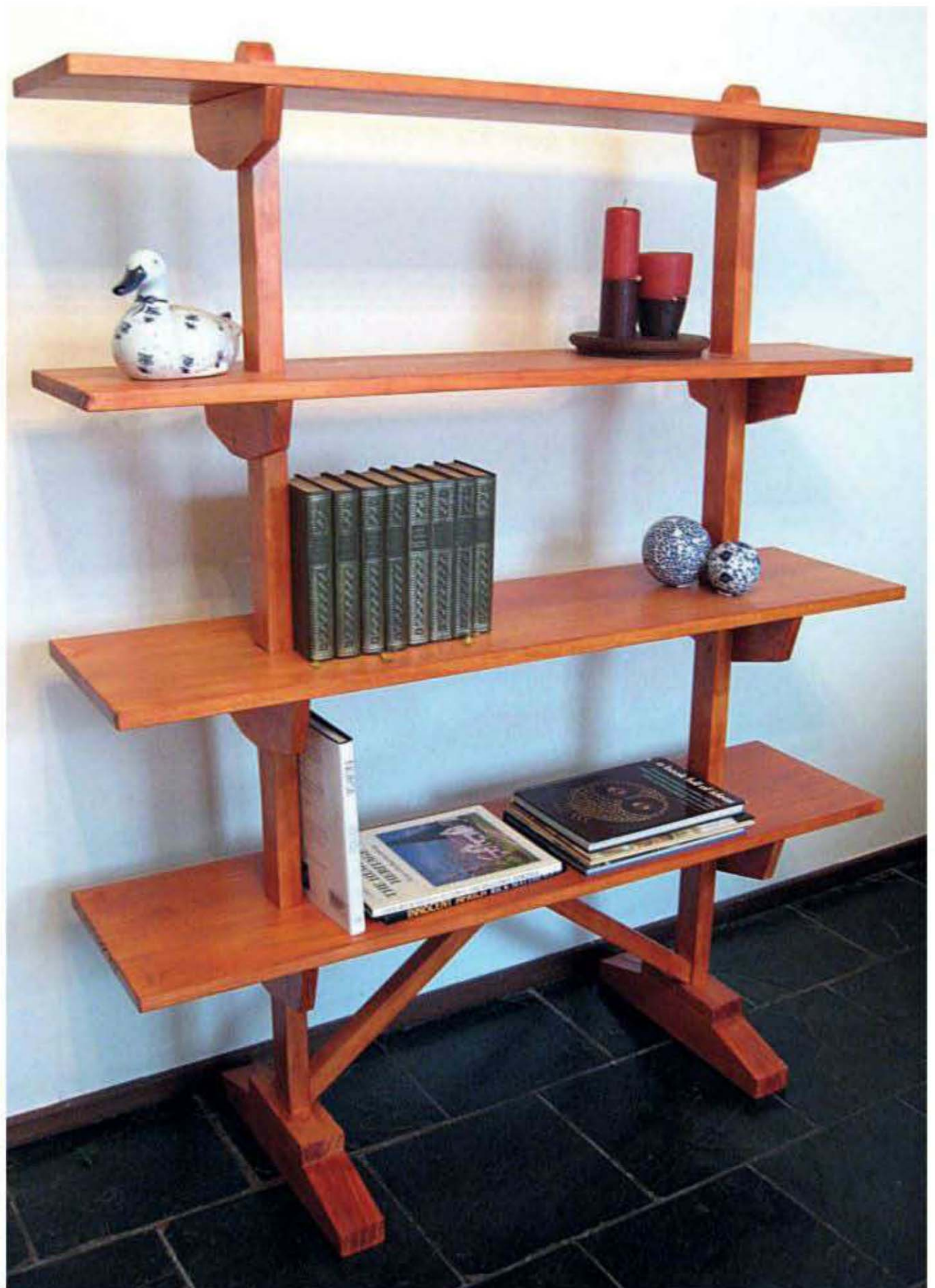
> COOL FACTOR: ****

PM

NEW TWIST *on that* OLD SHAKER

Shaker furniture is a distinctive style developed by the United Society of Believers in Christ's Second Appearing (aka Shakers), a religious sect that travelled to America from Manchester, England, in 1774. Inspired by the sect's ascetic beliefs, the furniture is widely admired for its simplicity, innovative joinery, quality and functionality. In fact, the underlying principles of Shaker design have inspired some of the finest designers of modern furniture. The original of the piece featured here was manufactured around 1830 by the Hancock Shakers as a rack for storing household items. It's a simple but challenging project for the woodworker, requiring a minimum of hand- and power tools. All the timber can be pre-cut to size from standard 20 mm laminated pine shelving and 32 mm pine board (see cutting layout and cutting list; figures 1 and 2). No screws are used, all the pieces being dowelled together, as was the original.

BY JEFF HOLLINGDALE AND
LYNTON DENNILL



TOOLS

- Tenon or dovetail saw
- Jigsaw fitted with 2,7 mm-pitch tooth wood blade
- Electric drill
- Electric hand sander
- Wood rasp
- Dowelling bit (8 mm)
- Selection of wood drills
- Selection of wood clamps
- Sliding steel bevel
- Set square
- 13 mm and 19 mm chisels
- Rubber mallet
- Small hammer
- Marking pencil
- Safety glasses, dust mask, ear protectors

MATERIALS

- A cutting list and layout is shown in the drawing (Figure 1)
- 8 mm dowelling (1 m lengths)
- 80- and 120-grit sandpaper
- Scrap MDF and 3mm hardboard
- Wood stain and wood finish



FIGURE 1: CUTTING LAYOUT

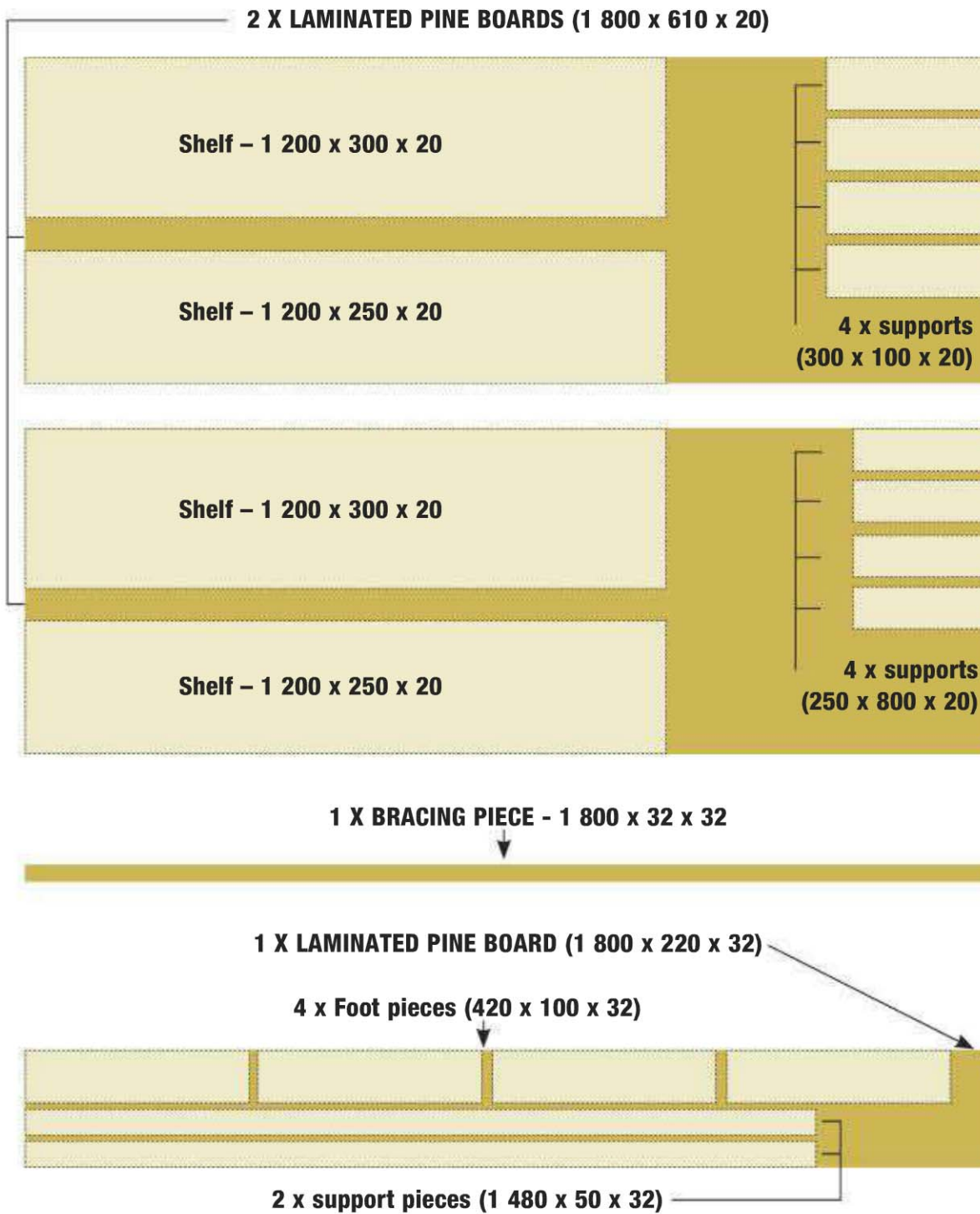
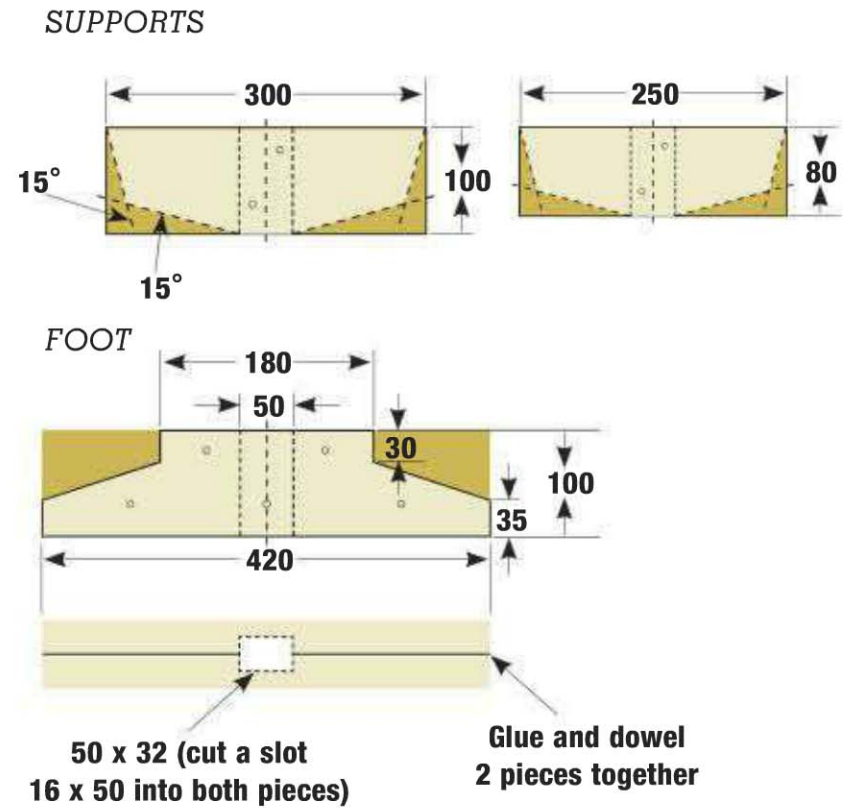


FIGURE 2: CUTTING LIST

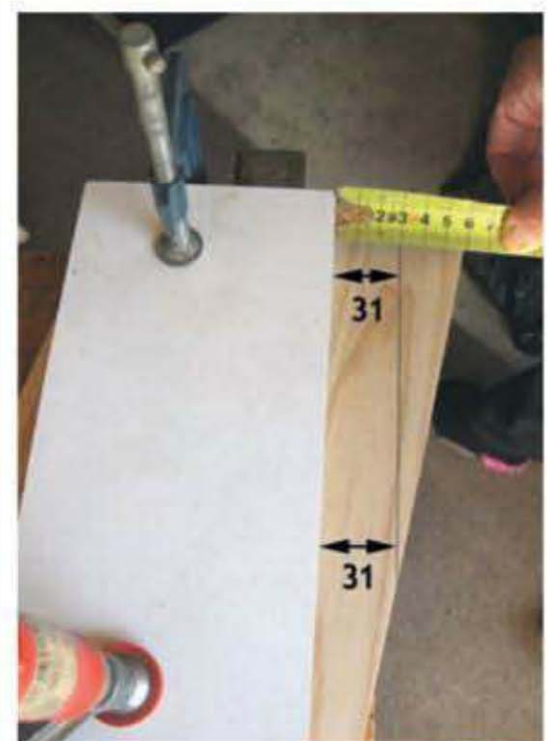
2 X SUPPORTS (1 480 x 50 x 32) ROUNDED ON ONE END



STEP 3

Use a jigsaw to cut the shelf support pieces. If you feel confident, you can do this freehand; if not, use a straight length of wood as a guide. Clamp the guide piece to the workpiece and the bench. Check the offset from the edge of the jigsaw guide plate to the cutting edge of the blade.

On our jigsaw this measured 31 mm. You need to set this offset from the



STEP 1

USE THE CUTTING LAYOUT AND LIST ABOVE TO CUT ALL YOUR PIECES TO SIZE BEFORE PROCEEDING WITH THE NEXT STEP.

STEP 2

Start by marking out all the pieces. The angles for the 15-degree cuts can be set on a bevel protractor with a simple plastic school protractor; we used an angle divider and a sliding bevel.



STEP 4

line marked on the workpiece to the guide piece. Keep the jigsaw guide plate square to and firmly in contact with the guide piece. Keep your fingers away from the blade and don't forget the safety glasses and ear protection while you're cutting!



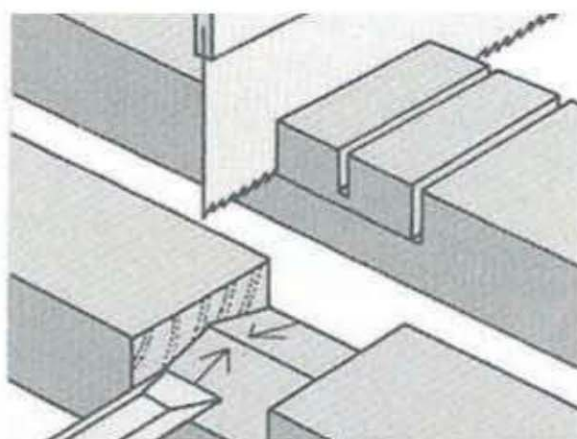
STEP 5

Cut the vertical supports to length. Round off the ends by using a suitable object to draw a curve. We used a "Brummer" wood filler pot. Cut around the marked curve with the jigsaw. Start cutting the half-tenons in the foot pieces. (Use a tenon or dovetail saw for this job.) Check, using a scrap piece of the vertical support 50 x 32 mm timber, that the width of the half-tenon marked matches the width of the timber. Re-mark if necessary.



STEP 6

Carefully cut down to the depth required. Use a 19 mm chisel to trim out the waste.



STEP 7

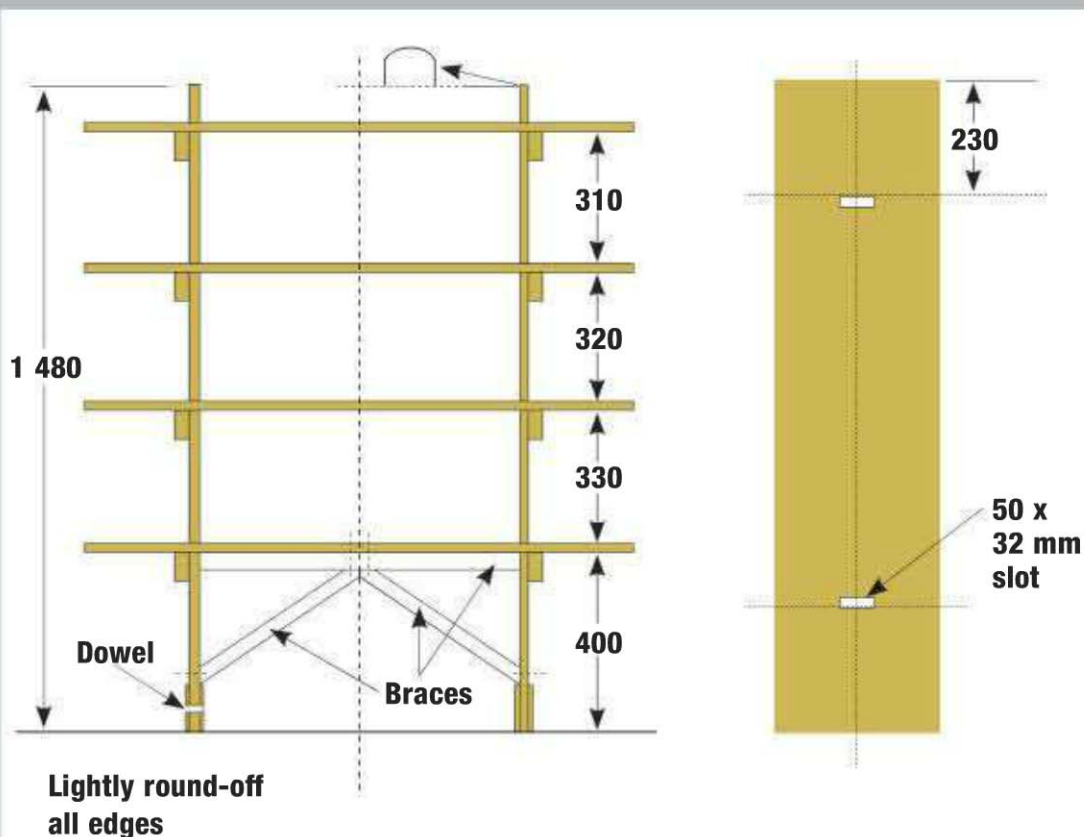
Complete the half-tenon on the remaining pieces. Test-fit pairs of the foot pieces together around the vertical support to check for fit and shape alignment. Ease out the tenon with the chisel if necessary. Mark the "best fits" of pairs of foot supports.

Clamp the pairs together and check the alignment of the pencil markings for the foot profile. Correct to bring into alignment if necessary. Use the tenon saw to cut the vertical profiles marked on the foot piece. Work slowly and carefully, keeping the saw vertical to the workpiece. Remove the clamps and use the jigsaw to cut the sloping profile to the vertical cuts.



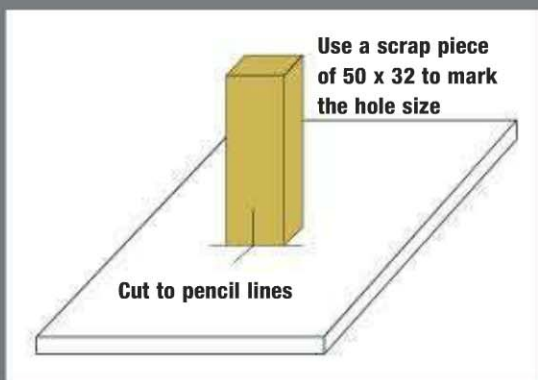
STEP 8

Now we can move on to cutting the holes in the shelves: mark the position on the shelves where the holes are to be cut.



STEP 9

Use a "squared-up" scrap piece of the vertical supports and pencil-mark the outline of the hole to be cut.



STEP 10

Drill a 10 mm hole in the centre of the hole cut-out and four 3 mm holes at each corner of the marked cut-out. Clamp the shelf to the workbench and use the jigsaw to cut from the centre to each corner. Turn the jigsaw to cut progressive arcs until enough space is created to trim to the marked lines.



STEP 11

Test-fit the piece of scrap vertical support to see if it slides easily (but not too loosely) through the cut-out. You may need to ease out the sides of the cut-out using a chisel and a wood rasp. Repeat the process on the other end of the shelf, and on the remaining three shelves.

We've now reached the point where we do some tedious labour – sanding! First, make sure you're using a dust mask, safety glasses and ear protectors. Start with an 80-grit paper and with whatever type of hand sander you're using; remember to sand with the grain. Check the state of the paper at frequent intervals to ensure that it's not torn or clogged; if this happens, change to a new sheet. Finish with a 120-grit paper.

"Break" all sharp edges by sanding at 45 degrees to the edge. Don't rush the sanding.



STEP 12

The next step is to prepare drilling templates for the shelf supports. We cut these out of 3 mm white-faced hardboard using the shelf support profiles as the guide to cut the templates. A 5 mm drill was used to mark and drill pilot holes through each support. Use a piece of scrap wood under the piece being drilled to avoid breakout.



STEP 13

At this point, the foot pieces can also be assembled to the vertical supports. Apply a thin layer of glue to the insides of each matching pair, and position the vertical support between each pair. Lightly clamp the pieces together, using a small piece of plywood or MDF on either side of the clamp jaws to avoid marking the workpieces. Tap the vertical support flush with the base of the support pieces, then tighten the clamps.

Next, drill a 5 mm pilot hole through the dowel securing points. Run an 8 mm drill through each hole. Cut lengths of about 75 mm of 8 mm dowelling (we bought grooved dowelling from our local hardware centre in 1 m lengths). Prepare each piece of dowelling by sanding a blunt point on one end. Lightly glue each dowel before inserting.



STEP 14

Drive the dowelling through the full width of the foot piece until at least 5 mm protrudes on each side. Set aside the vertical support and foot piece to allow the glue to harden. The dowel ends can be trimmed by first trimming the excess with a dovetail saw, then carefully using a chisel to cut flush to the surface. A light sanding completes the process. When cutting off the dowels with the saw, use a piece of sandpaper (grit side to the workpiece) to avoid leaving saw marks on the wood.



STEP 15

Warning: keep your fingers clear of the saw blade! You can decide at this stage whether to do some of the staining work prior to assembly or wait until everything is assembled. We opted for partial staining. Stain colour used is a matter of personal choice; we like Novadye "Oregon". If you do decide to stain at this stage, don rubber household gloves. Use a small square of cotton rag (old T-shirts are good for this) and fold into a small square pad. Soak the pad with stain – don't get splashes on the workpiece – and rub the stain with the grain. You'll have to go over the piece several times to get the stain to "take" and leave you with an even, non-streaky finish.

You can tackle most of the cut pieces, including the shelves, but be careful not to get stain on sections of the pieces that will be glued together. If necessary, use masking tape. The picture below shows the stained components ready for assembly.



STEP 16

Start assembly by marking and drilling each of the side supports. Remember that the bigger (300 mm-wide) supports are mounted towards the bottom of the vertical supports. Mark and check (on the vertical supports) the top position at which each support will be mounted. Use a right-angle square to set the supports square with the vertical supports.

Next, clamp the support in position so that the body of the electric drill does not foul the clamp, and drill a 5 mm pilot hole. Temporarily locate the work with another 5 mm drill while you re-position the clamp, check squareness again, clamp in place, and drill the second 5 mm hole.



STEP 17

Mark the support and its position on the vertical support (gluing side) with the number 1 so that you can match its position when dowelling and gluing. Repeat this process with the remaining supports. Cut a number of pieces of grooved 8 mm dowelling to about 65 mm in length. Use sandpaper to taper one end. Begin gluing and dowelling only with the lowest pair of supports.

Glue the inside of the support only where it contacts the vertical support. Position the support in place, using a 5 mm drill to locate one of the holes. Lightly clamp the support to the vertical support. Carefully align the support square to the vertical support. Check with a right-angle square, then lightly clamp the support in position. Drill an 8 mm hole through one of the 5 mm hole positions. Next, lightly glue a piece of dowelling and tap it through the work pieces until the dowelling protrudes about 5 mm. Remove the locating drill, then drill a second 8 mm hole. Dowel again.



STEP 18

Clamp the pieces together, removing any excess glue with a damp cloth. Repeat the process with the other lowest support piece. Take one of the 300 mm wide shelves and carefully ease it over both vertical supports. Hand-tap it down the supports until it meets and sits on the two lowest shelf supports.

Now you're ready to mount the next pair of shelf supports up from the bottom. When the supports are mounted, tap the second (300 mm-wide) shelf into position. Repeat with the next set of 250 mm-wide shelf supports. Fit one of the 250 mm shelves. Finally, fit the last pair of 250 mm supports. At this stage there is no need to fit the top 250 mm shelf. Next, dress all of the dowels, cutting and trimming them flush with the shelf and vertical supports.

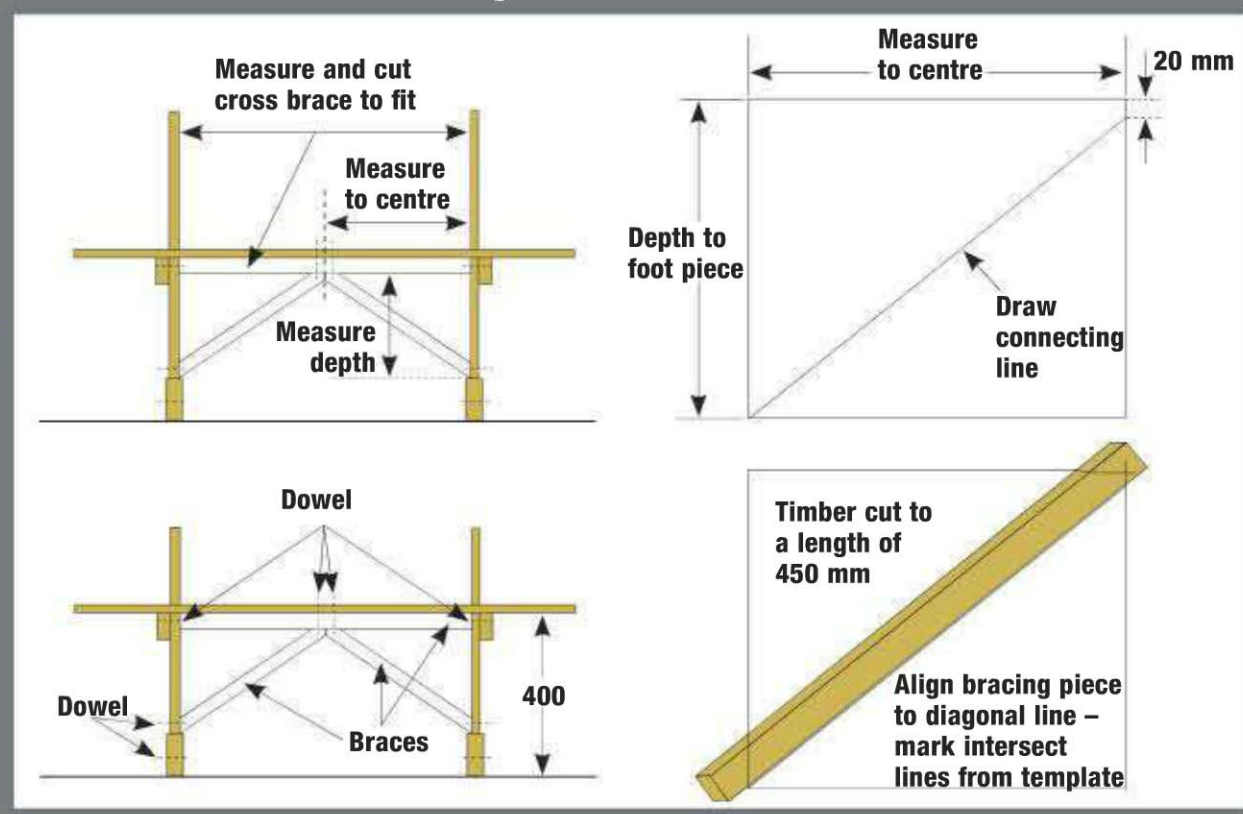
We're now ready to fit the bracing. Start with the horizontal bracing: with the lower shelf sitting on the shelf supports, carefully measure the length to each inside vertical support. Mark this length on to a piece of 32 x 32 mm material. Mark the cutting lines around each side. You now need to cut the material to length with the ends square.

Dry-check its fit to between the vertical supports. This piece will be fitted using hidden dowels. Carefully mark the centre of both ends. Mark the position of the horizontal bracing on the inside of each vertical support. Tap the lowest shelf up as far as it will go. Next, using the 8 mm dowelling drill, drill holes about 20 mm deep on both sides of the vertical supports and in the ends of the horizontal bracing piece.



STEP 19

Lightly glue and tap 35 mm long dowels about half the length into the bracing piece. Lightly glue the ends of the bracing piece and the protruding dowel ends and fit the horizontal brace into position. Clamp the vertical supports to the bracing piece (we used a ratchet-type luggage strap). Small pieces of right-angle aluminium are used to protect the wood. Ratchet-up until the horizontal brace is firmly clamped to the vertical supports. Wipe off any excess glue using a damp cloth. The next step is to fit the cross braces. This is best done by making up a template from stiff white A3 card; the diagram below shows how.



STEP 20

Carefully mark up and trim two pieces of 450 mm (32 x 32 mm) to size. Note that one piece is the mirror image of the other. Dry-fit to ensure that they match and meet in the centre as shown in the diagram and in this view. Pencil-mark where the ends meeting the vertical supports are centred.



STEP 21

Glue the ends of the two pieces and fit into position. Again, we used a ratcheted luggage strap to pull the pieces tight and into position.



STEP 22

Drill 8 mm dowelling holes into the top side of the horizontal brace centred to where the cross braces meet. Do not drill all the way through; about half the depth into the cross brace is sufficient. Lightly glue and tap two 8 mm dowel lengths into position. Re-tighten the strap if necessary.

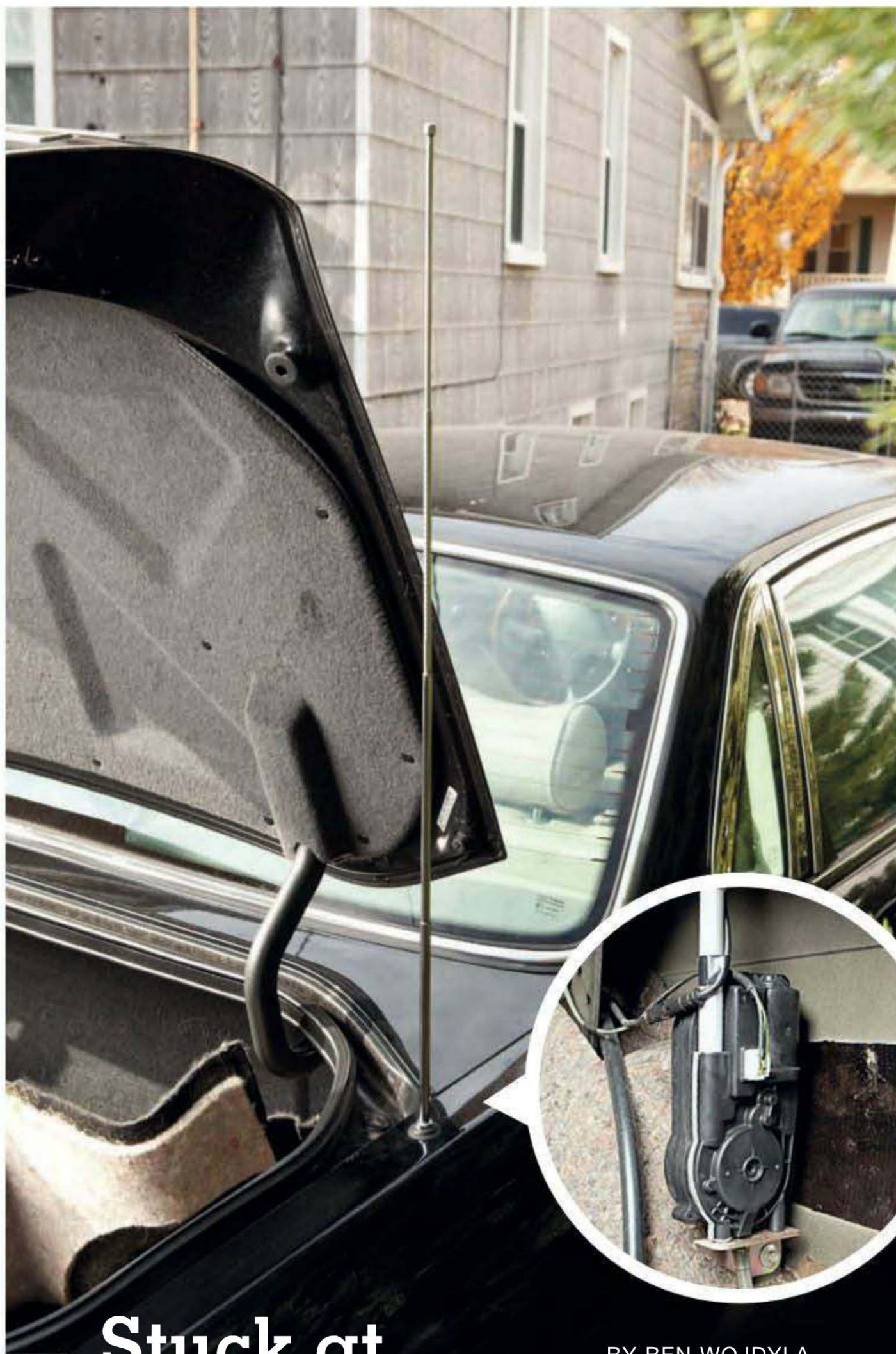
We're now on the home stretch. Cut and trim all the dowel ends wherever they have been used, flush with timber surfaces. Lightly sand over to finish. Place the assembly on the floor, resting it on two long pieces of timber or on old mats.

Finish staining all surfaces, using a small brush to get inside awkward corners. Turn over the assembly to complete both sides. We spray-finished our unit with two coats of Elvolac acid catalysed lacquer satin finish thinned with about 20 per cent lacquer thinners. You could also brush-finish with polyurethane lacquer.

Enjoy the journey!

● If you would like more information on this project or would like to purchase a pre-cut kit, contact Lynton Dennill at ldennill@gmail.com

PM



Stuck at HALF-MAST

BY BEN WOJDYLA

Telescoping antenna masts are almost extinct, but if you have one, it will eventually need to be fixed.

Electric-powered, self-extending antenna masts used to be a tell-tale sign of a fancy, feature-laden car.

As is the case with many electro-mechanical parts, however, power antennas usually end up requiring repair. Run through a carwash with one extended and you'll have what looks like a bent hanger sticking out of the fender. Today, power antenna masts have been replaced with fixed antennas or wires embedded in windshields, but there are still plenty of cars out there with these telescoping menaces. Broken antennas get stuck all the way up, all the way down, or often somewhere in between. The shabby appearance of, and stunted radio reception on, an otherwise perfectly good car means that replacing or repairing an antenna is a worthwhile fix.

It's almost too bad these have gone out of style; they are actually pretty elegant in a Heath Robinson kind of way. An electric motor hidden below the fender turns nylon gears that eventually mesh with a toothed nylon rope matching the gears. That rope extends all the way through the hollow antenna sections and mounts to the tip. As the motor turns the gears, the rigid rope is pushed or pulled and the mast advances or retracts, stopping based on either a digital counter or timer or on a measured spike in voltage when the motor can't turn any more.

As you might imagine, there are several ways these antennas malfunction. The most prevalent is a bent mast – even slight tweaks to the tight-fitting telescoping tubes can cause havoc. The nylon bits are a problem, too; teeth from the gears or rope break off from wear or cold or the rope snaps along the length. Sometimes the antenna fails when the components just plain get dirty – rain and dust infiltrate the mechanism, and things grind to a halt. Below we're going to walk through the general steps of removing the whole assembly, taking it apart, then cleaning and replacing the problem parts.

STEP ONE

Extract the problem part

First, you'll need to get to the mechanism. If the antenna is rear-fender-mounted, remove the boot trim panels to gain access. Front-fender units may be inside the engine bay or behind the inner fender. You'll likely need a few screwdrivers and spanners. The mechanism is usually easy to remove – loosen any bolts and disconnect the earth strap, antenna signal wire and motor-control wires. Be careful with the connectors because they will be reused. Remove the assembly by pulling the antenna mast down through the fender.



STEP FOUR

Reinstall the unit

If new gears are called for, assemble them as before; most of the time they just drop into place. Compress the mast completely and run the nylon rope down the tube, then seat the base into the housing. You may need to tap it home gently with a hammer. Fully extend the antenna, then mesh the end of the nylon cord back into the gear drive and reassemble the cover and housing.

With the mechanism still loose, plug in the electrical connections, then turn the radio on and off. This should cause the gears to pull on the nylon rope and retract the mast. If the mast doesn't go down, the gears of the nylon rope may not be properly aligned, so you'll have to try again. Reinstall the assembly and bolt the mast bushing back in place. Now enjoy one less annoyance, at least until you forget to turn off the radio in a carwash again. **PM**

STEP TWO

Dissect and diagnose

Uncover the device's guts by extracting the cover screws. Carefully remove the housing and gear cover, as the nylon cord within might spring out and fling smaller parts. Inside, you'll see how the motor, gears and nylon rope work together. If the teeth on the rope or gears are stripped, you'll need to remove all the broken pieces. There will undoubtedly be old, dirty grease that may or may not be the problem, but should be cleaned out. Inspect everything else for signs of damage; if a major part such as the housing or motor is broken, replace the whole assembly.

STEP THREE

Fix the bits

If the telescoping mast is the problem, remove it by taking off the bushing at the top of the guide tube; it keeps the mast in place. With a firm grip, pull the mast out along with the nylon rope; pliers may be needed. Clean everything, including the gears, with a mild cleaner such as dish detergent. Lubricate the clean gears and housing with white lithium grease; it works well even at low temperatures.

SPARE THE TYRE

SPARE TYRE

DIMENSIONS:

T125/80/R16

OUTSIDE DIAMETER:

605 mm

MAX SPEED:

130 km/h

FULL-SIZE TYRE

DIMENSIONS:

215/55R16

OUTSIDE DIAMETER:

643 mm

MAX SPEED:

210 km/h



Brian Kelly

Q I had a flat tyre a while ago, so I mounted the space-saver spare. I'll admit I left it on for way longer than the owner's manual suggests. Eventually, I replaced it with a full-size tyre, but I've always wondered why manufacturers say you shouldn't use the spare for longer than necessary.

A Since the spare tyre is used so infrequently, motor manufacturers have switched to narrow, compact spares to save space and weight. Of course, a spare tyre is a lifesaver when regular tyres go pop, but leaving the temporary tyre on for longer than the manufacturer recommends invites a host of problems. First, a temporary spare isn't as durable as a normal tyre. The real strength of a tyre comes from the plies – layers of steel and polyester underneath the rubber – and spares don't have as many plies as regular tyres. A typical space-saver spare has only one layer of polyester in the sidewall and two belts of steel with a layer of polyester in the tread – about half as many plies as a normal tyre. This greatly limits puncture resistance and cornering ability. In addition, as the name implies, space-saver tyres are intended to take up less room in car and crossover boots so that those trunks can be deeper. For that reason, these tyres are narrower and have a smaller contact patch. This reduces the amount of traction for the tyre, increasing stopping distances and making handling potentially unpredictable in emergency

manoeuvres. It also means ABS and traction control aren't as effective at keeping you out of danger. And you're not going to have the same ground clearance. If you're towing a trailer, you'll have to leave it behind – spares have much lower load ratings than regular tyres. Long-term use of the spare can cause a serious mechanical issue, too: the smaller-diameter tyre can put a lot of stress on your differential.

The differential has a tricky job. It transmits engine power to the wheels from the transmission, but it also lets

the left and right wheels turn at different speeds. This is essential for cornering. In a turn, the path of the inside wheel is shorter than that of the outside wheel, which means they travel at different speeds. When your car is driving in a straight line, the differential isn't in use and there's little wear and tear on its gears and bearings. But because the spare is smaller than the opposing wheel on the same axle, it must turn faster to keep up with the speed of the car, making the differential work to account for the variation. It's as if the car is constantly in a turn. Leave the spare on long enough and the grease lubricating the differential will begin to break down, accelerating wear between the gears and the clutch plates if it's a limited-slip differential.

For all these reasons, manufacturers suggest keeping speeds below 80 km/h and using the spare tyre only for limited distances if possible. If a compact spare is ever damaged, either the tyre itself or the wheel, the entire spare should be replaced rather than repaired. And don't forget to check the pressure in your spare every time you check the pressure in your other tyres – it's important to make sure your safety net is, in fact, safe.

STICKY SITUATION

Q I got a great deal on a low-mileage 1990 model, one of those little-old-lady liquidation cars everyone dreams about. The only problem is, it came with quite an array of bumper stickers that I didn't particularly want to leave on. I peeled them all off, but the entire back of the car is covered with sticky residue and none of my regular cleaners can get it off. I'm wondering if I can use my buffing wheel, or if you have a better idea?

A I've been there – you find a mint used ride and there's something stuck to the back you want nothing to do with. Although a buffing wheel and some compound could remove the residue, that's not what those tools really are designed for.

Anyway, there are two products that will remove the sticky stuff quickly and easily. One is good old WD-40. Spray it on and let it sit for about 5 minutes, then wipe it away with a cloth. You may have to repeat the process a few times, but it always works. I like to use a dedicated label remover. This kind of product (Servisol is one brand name) usually gets even the most stubborn goop off in the first try, without damaging the surface



PM TOOLBOX

TOOL INDULGENCE

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underneath it. When you've got all the sticker leftovers cleaned away, the paint will probably be scuffed up and splotchy. Break out the wax and give the area a once-over, and that classic will have a rear end you can be proud of.

FLASH DANCING

Q I have an old high-mileage '95 SUV. The rear indicator-signal lights have started flashing very rapidly. I always thought this was caused by a burned-out bulb, but both the front and rear lights are flashing quickly. How do I fix this?

A Start by looking at the widget that makes the signals actually blink, the thermal flasher, aka the indicator-signal relay. For most of its history, the relay has remained largely unchanged. It works by passing current through a thermal element that heats up, expands and closes a connection between the 12-volt power source and the bulb, sending power to the signal light. The thermal element then cools and contracts because the current isn't passing through it, opening the circuit and turning off the light. The most likely cause of your rapid flashing is that the relay has worn out and the springs it rests on have lost their bounce.

Fixing the problem is easy and cheap. Head to your local spare parts store and

ask for an indicator-signal relay for your vehicle. They'll hand you a small, round, metal part that looks a bit like a little stockpot turned upside down. Root around in your fuse panel to locate the matching part and replace it – your owner's manual or the lid of the fuse-box cover will help you find where this part is hiding. Most of the time, the replacement part looks almost identical to the original. Switching the parts is as easy as pulling the old one out and popping the new one in.

STOP ME, SOMEONE

Q I drive a 10-year-old Toyota Corolla that's starting to give me cause for concern. When I brake for a stop street or traffic light, the whole car tries to veer to the right, and I end up fighting the steering wheel. Should I be worried?

A Yes. This problem is usually caused by a frozen calliper or wheel cylinder piston, a fluid-contaminated brake shoe lining, a leaking cylinder or (more rarely) a layer of brake lining dust. Faulty front-end alignment may also cause your car to veer to one side. If you're not mechanically inclined, talk to your local mechanic very soon.

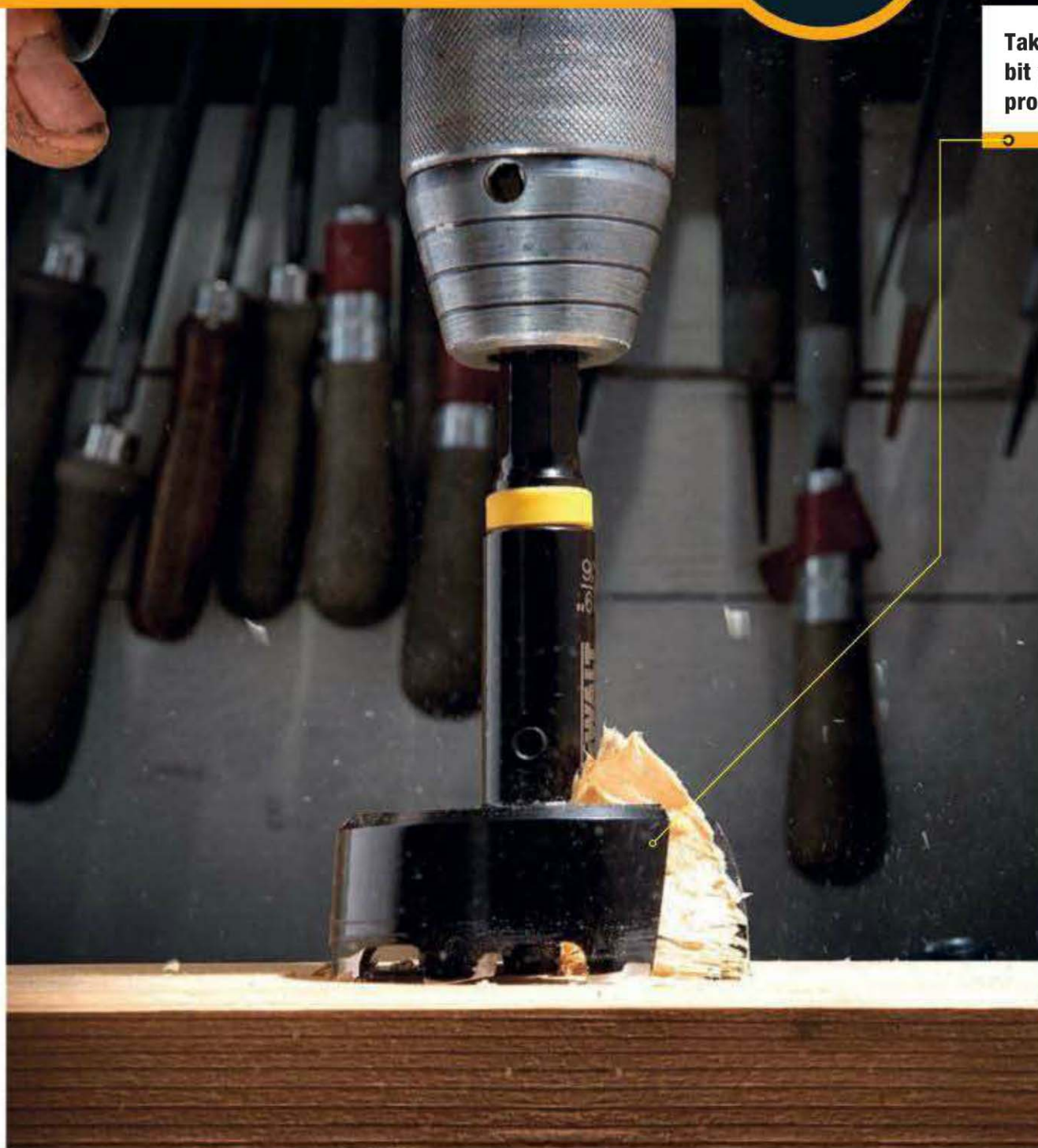
PM

DIY HOME

> BY ROY BERENDSOHN

Q+A

Take it easy when boring big holes. Regardless of the bit you use, back off to clear chips and sawdust, then proceed. It'll be easier on you, the drill, and the bit.



BORE, BABY, BORE!

Q I've got some internal remodelling to do that entails drilling large holes in the studs and joists of drywalling. What works better, a hole saw or one of those big drill bits that contractors use? I have a 12 mm drill. Will that do the trick, or should I rent a larger one?

A When plumbers and electricians need to drill a large hole in framing timber or other material – to make way for pipes and wiring – they usually opt for a self-feed bit (above). Such bits max out at a diameter of about 10 cm. Another choice for the pros is the auger bit, which can drill holes about half that size. Hole saws present a third option, though they can be problematic, which I address below.

The last part of your question tells me that you understand an important, basic fact about using these bits: it takes a big drill with lots of torque to spin them. Contractors use specialised tools with the

chuck at a right angle to the motor. The 90-degree design allows what is known as a joist drill, or a stud-and-joist drill, to fit between wall studs and floor joists while driving the stubby self-feed bit. More advanced versions of these drills have a clutch that prevents them from breaking your arm if the bit grinds to a halt and the torque transfers to the handle.

So, can a standard 12 mm drill power a self-feed bit? Maybe. Your drill will certainly get a workout – and you may risk frying the motor – if you use a bit larger than 50 mm. Any bit bigger than that probably dictates that you rent a

more powerful drill; ditto if you're going to be cutting a lot of holes. Even so, this type of drilling is tough work. Take your time, and be sure to use a heavy-duty extension cord.

That brings us to hole saws. Certainly one of these bits can bore through framing timber, especially when chucked into a 12 mm drill. But hole saws have some drawbacks. Their shape and cutting action don't eject chips and sawdust, so you repeatedly have to back out the saw to clear debris. That makes a hole saw slower in thick material than a self-feed bit. You also need to pry out the plug of wood that the saw creates. Better-quality hole saws have stepped slots in their body to make removing the plug easier.

Be sure to gauge the size and position of any hole you drill so that it doesn't damage the framing timber. The International Residential Code allows a hole that's up to 40 per cent of the width of a stud in load-bearing walls or 60 per cent in non-bearing walls. (That translates to holes of 35 mm or 28 mm.) In either case, the hole should not be closer than 16 mm to the timber's edge.

Those are the basics. For a more detailed take on the topic, there's plenty of good advice online.

CAULK TALK

Q I'm installing baseboard, door- and window-trim moulding. I'd like your opinion: should I seal the trim to the wall?

A In most cases, it's not necessary to use sealant on the trim, especially if you carefully nail it so that the trim pulls tightly against the wall. But if you need to fill some gaps, use sealant sparingly. Cut the tube tip to a small opening and be fastidious about wiping off excess material.

To be clear, I don't have a problem with sealant; in fact, I use it all the time. But generally speaking, it's overused. Sloppy application is common, and not pretty. When the sealant begins to pull away from the trim and the wall, things can get ugly. If you use high-quality trim and do a good installation job, you can avoid the need to use sealant altogether. **PM**

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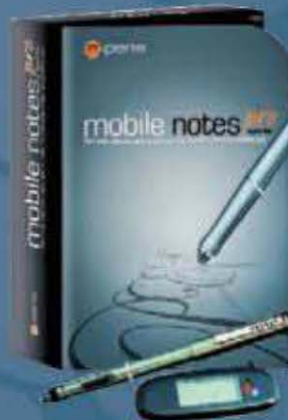
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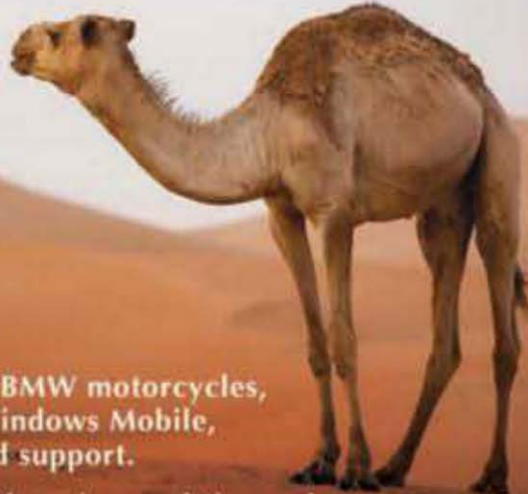
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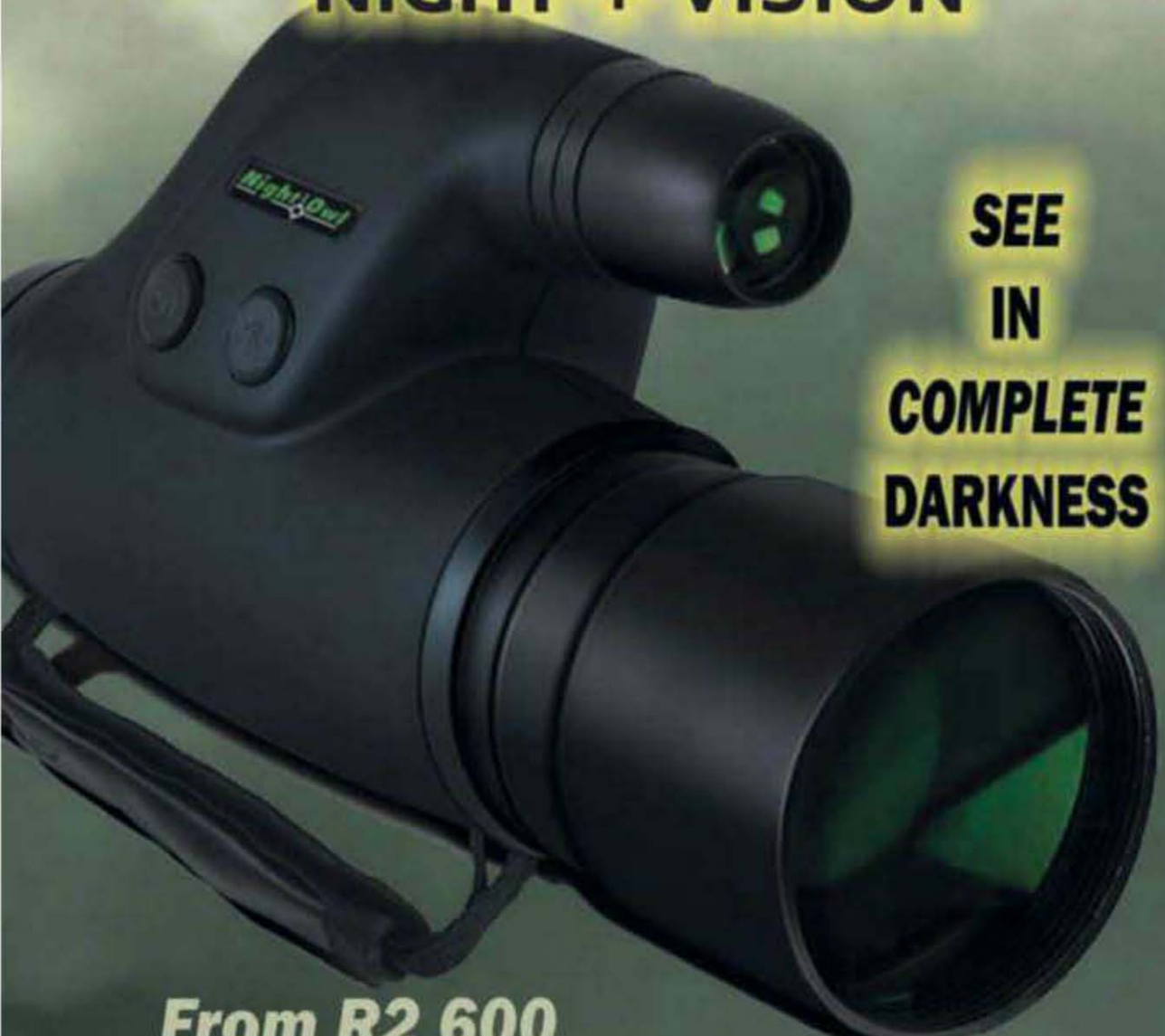


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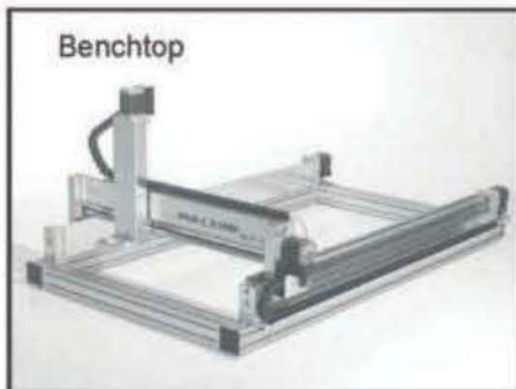


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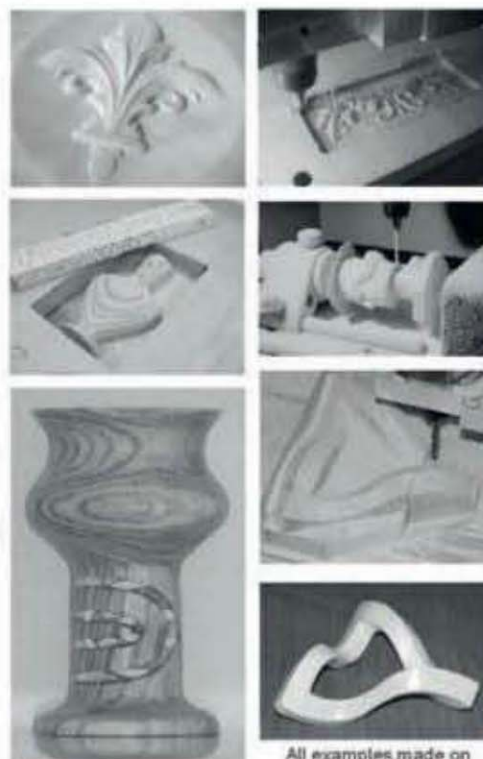
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WINNING TIP

PCB 101

If you're a hobby enthusiast and want to make your own PCBs (printed circuit boards) for electronics projects, here's how. First, design your circuit using CAD software such as DesignSpark (download free from the Internet). Print the tracks on paper using a laser printer (inkjet printers don't work), then use a *hot* iron to iron the printed tracks on to the copper side of a piece of copper-clad board, pressing firmly. Once the paper has turned grey, soak it in water until you can gently peel the paper off, leaving the printed tracks on the copper.

Next, mix 3 parts pool acid to 1 part peroxide, pour over board and allow it to soak. The mixture will eat away all the copper except the tracks, since these are covered with the toner from the laser printer. Once all the excess copper is gone, clean the tracks with methylated spirits. Use a 0,8 mm drill bit (in a drill press) to drill holes for the components, and *voila!* You have your own custom-built PCB.

NICK PEACOCK
BERGVLIET



On the level

If you want to check the accuracy of your spirit level, here's how: first, mark one side of the level so you can distinguish it

from the opposite end, then slip some playing cards under one end of the level until the bubble is centred. (If the bubble is already centred, you won't need the cards). Next, flip the level around 180 degrees (end for end) and rest it on the same stack of cards. If the bubble is in the centre, your level is accurate. If not, it's time to get a new one.

MARIUS GROBLER
VIA E-MAIL



Safety first

In addition to the regulation red plastic triangle for placing behind my vehicle in the event of a flat wheel or breakdown, I slip on a reflective vest of the type used by construction workers. It makes one highly visible, and could mean the difference between life and death, especially at night.

NEELS KOEKEMOER
DURBAN

Clever ashtray

Here's a way to extract something useful from smokers while disposing of their ash and cigarette butts. Fill a plastic cool drink bottle halfway with water and use it as an outdoors ashtray. The water snuffs the butt immediately and the nicotine that dissolves from the ash makes a handy insect killer for your flower beds. When the contents have done their job, replace the bottle top and dispose of it in an environmentally acceptable manner.

CECIL GERICKE
HARTENBOS

Funnel vision

Someone drove over my tape measure, leaving it in pieces. Disgusted, I was about to throw it away when my son came up with an interesting use for the remains: he discarded the spring and

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pulled up the tape coil to create a handy metal funnel of variable length. After use, it reverts to its original, tightly coiled shape, taking up very little space in the kitchen utensil drawer. (Of course, it's equally handy in the workshop.)

DIVAN VAN DEN BERG
VANDERKLOOF

Stain begone

Have you ever tried to cover a stain on your ceiling left by a water leak? Many coats of ceiling paint later, the stain is still visible. Here is a neat trick that really works: make a watery paste of ordinary crack filler and paint it over the stain. Wait for it to dry, give it a light sanding to smooth out any imperfections, then paint over with your regular ceiling paint – the stain is gone.

JOHN BURROUGHS
VIA E-MAIL PM

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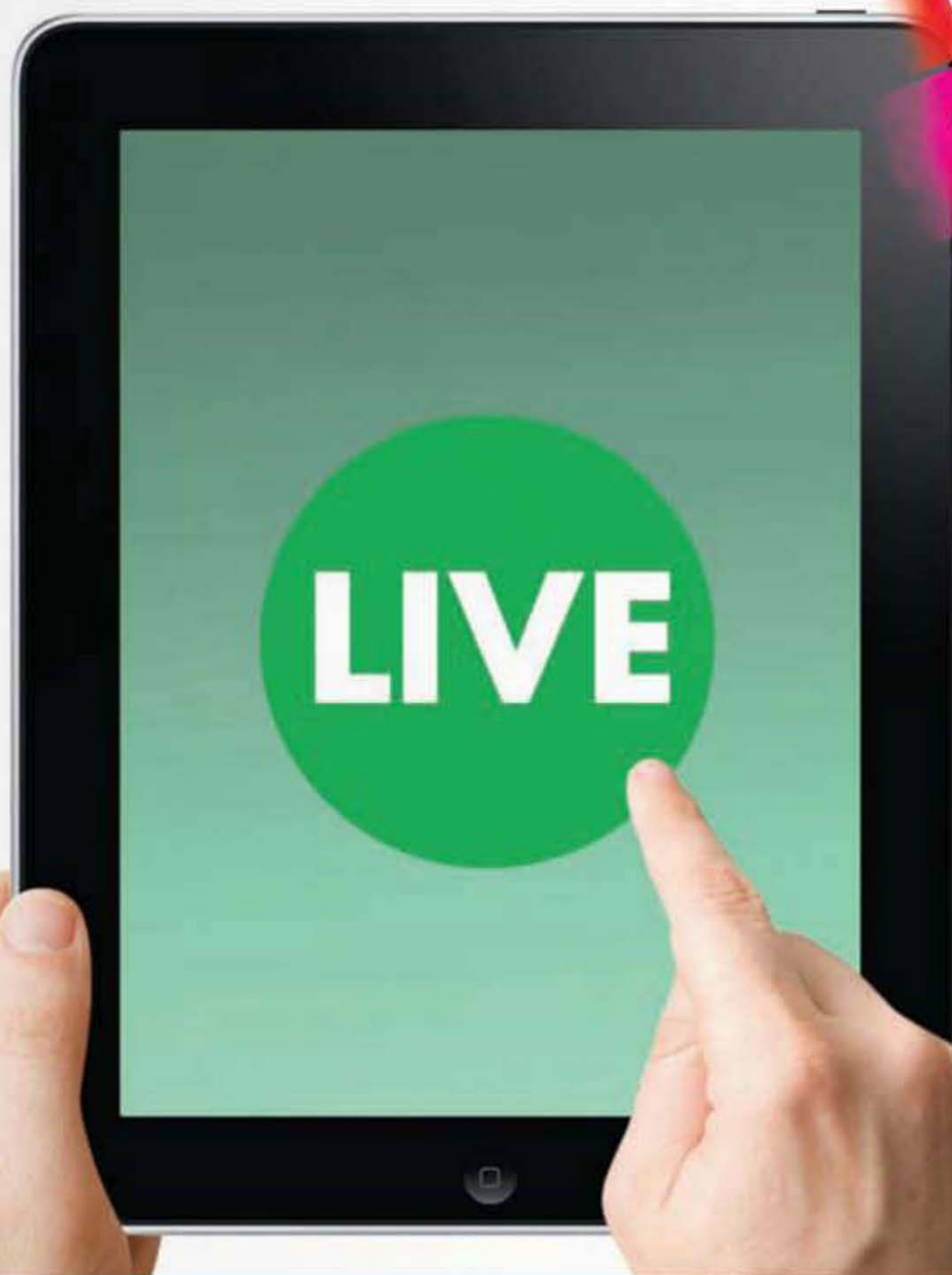


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